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Electrical World

APRIL 19, 1941

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23.2 13.9 % 11.8
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April 19, 1941

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Electrical World—Published weekly. Price 25 cents a copy. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, 330 West 42d Street, New York, N. Y. Subscription rates: In the United States, Mexico, Central and South American countries, $5 a year, $8 for two years, $10 for three years. Canada, $5.50 for one year, $9 for two years, $11 for three years (Canadian money at par) Great Britain and British possessions, 54 shillings for one year, 108 shillings for three years. All other countries $9 for one year, $18 for three years. Entered as second-class matter November 16, 1936, at Post Office at Albany, N. Y., under the Act of March 3, 1879. Printed in U. S. A. Contents copyrighted, 1941, by McGraw-Hill Publishing Company, Inc. Branch Offices: 520 North Michigan Avenue, Chicago; 68 Post Street, San Francisco; Aldwych House, Aldwych, London, W. C. 2; Washington, Philadelphia, Cleveland, Detroit, St. Louis, Boston, Atlanta, Ga.

Publication Office
99-129 North Broadway, Albany, N. Y.

Editorial and Executive Offices
330 West 42d Street, New York, N. Y.

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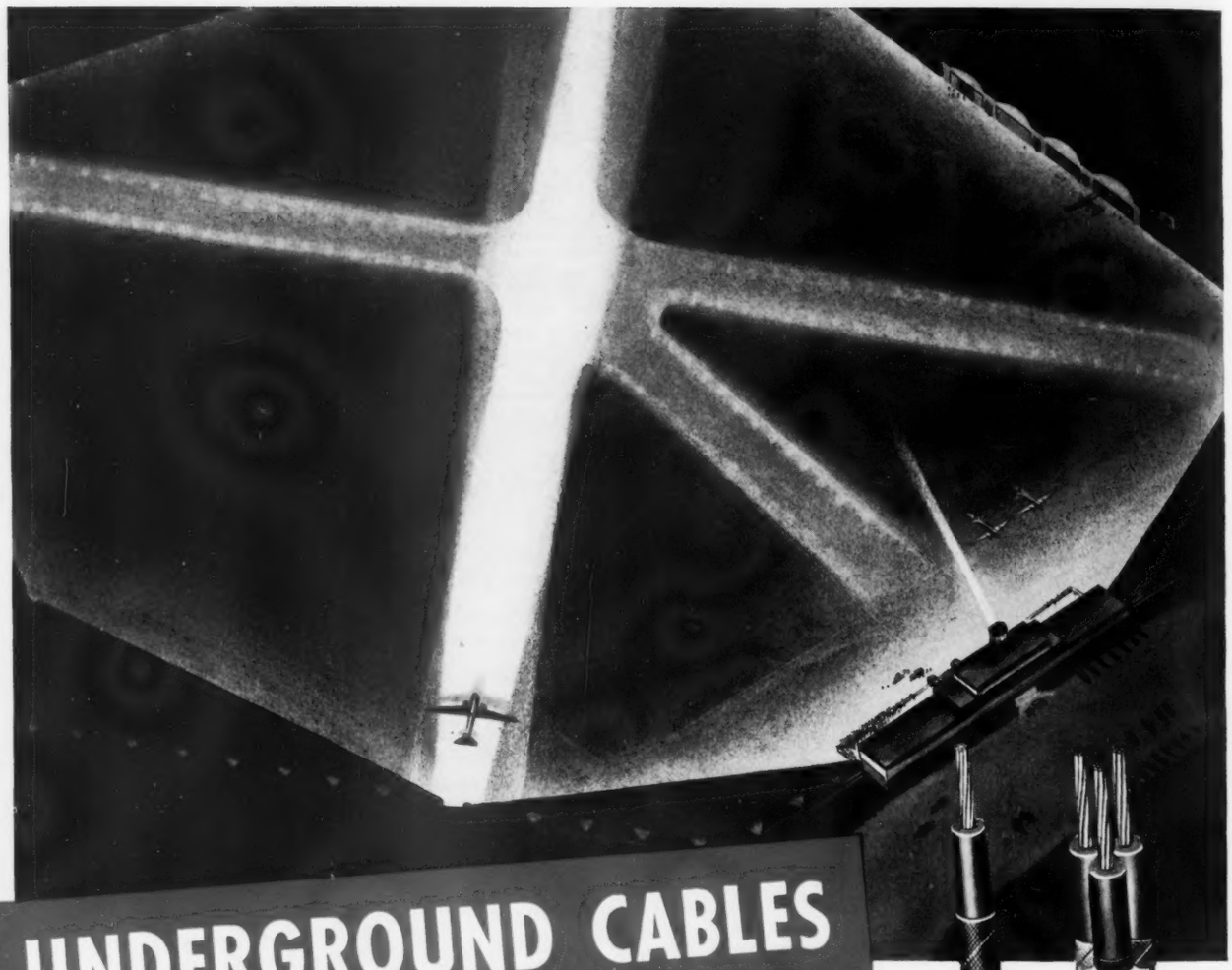

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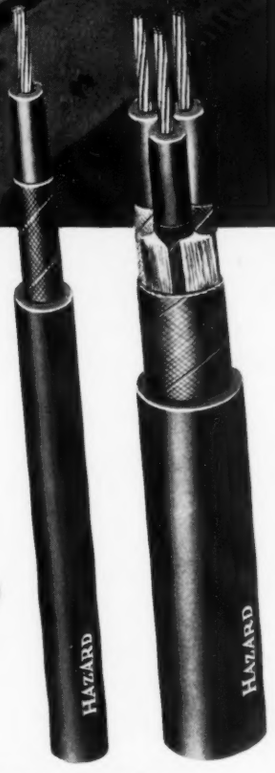

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The Reward for Loyalty

Within the past month several utility men of years' experience in supervisory capacities have asked our help in getting relocated. They are all good men—men who do not want to lose their connections with the utility business, but as one who is getting discouraged wrote, "I may have to go down to Washington and talk to ————, because it looks to me as though about 80 per cent of us will soon be working for the government."

Already a number of experienced utility men have gone to work for the government in some phase of its power program. These men are giving to those government power operations the only thing that prevents them from making extravagant blunders—sound practical experience gained from lifetime employment in private industry.

Men brought up in private operation will not turn to government employment unless they find no other comparable opportunity.

If holding companies and service organizations and associations and even some operating properties, as the result of the operations of the utility act, find it necessary to reduce forces, what is going to happen to these men? Are they to be left to their own devices or is management going to recognize a responsibility for loyal service in helping them get relocated and maintaining their economic existence?

In not a few cases men have been satisfied with modest incomes because of the implied and sometimes stated security of utility employment. Does that condition not impose some responsibility upon management when the time comes to reduce staff?

Young men are not going to find it particularly difficult, especially at this time, to find other employment at little or no loss in income. Older men, men who are worth every cent they are now getting in their present occupations, and perhaps more, are going to face a much more difficult situation. Few of them after spending a lifetime of utility service are going to have any idea of which way to turn.

It is to these men that the industry owes an obligation. Where situations arise that demand a reduction of staff, obviously there is nothing to do but let men go. On the other hand, some program might be worked out in the meantime whereby these men would not be left entirely to their own devices to get another job.

Central employment agencies do not appeal to men who for years have been department heads, but may it not be possible for a central bureau to be set up that not only would locate employment openings but would help men to merchandise their services? There are several instances where such bureaus conducted by the unemployed themselves have proven very successful.

We cannot dodge the fact that the policy of SEC in carrying out the utility act is one of disintegration. If this program is carried out it means loss of employment to a great many people. For that reason this is the time to prepare for such an event.

Men will be less preyed upon by fear and will have the incentive to do better work if they know that when the worst comes they will not walk out into a cold world, knowing no way to turn.

Record Speed in Cable Laying Meets Defense Demands

Thoroughgoing pre-set plan enables the Puget Sound system to meet defense needs quickly — Previous experience gives basis for conquering physical difficulties in laying 22,000-ft. length of 4.38-in. cable in 840 ft. of water

M. T. CRAWFORD,* Pudget Sound Power & Light Company, Seattle, Wash.

ADDITIONAL electric power to meet regional needs of the country's defense program is being supplied promptly and efficiently from the Puget Sound Power & Light Company system, just as other utility systems are meeting similar situations in their area. Among recent Puget Sound defense construction jobs was a submarine cable installation of unique proportions.

*Assistant chief engineer.

UNLOADING the single 22,000-ft. length of cable. Cable was shipped in four-car train of gondola cars. Cars were chained together and couplings locked. Cable loops between cars were protected with burlap

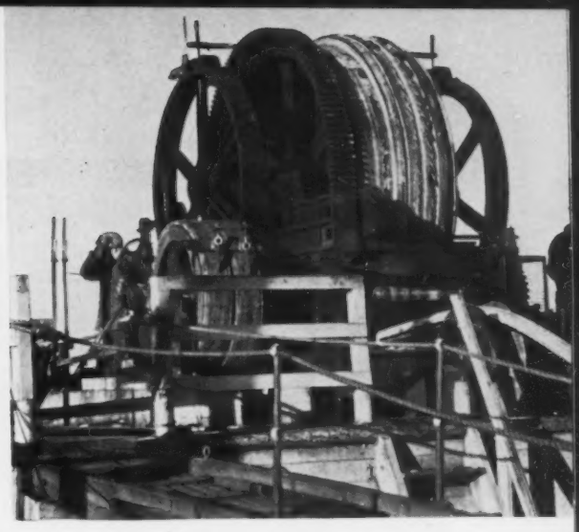
The topography of the Puget Sound area makes it necessary for electric power lines to make a number of long, deep water crossings, and a total of more than 28 miles of high-voltage submarine cable is installed on the Puget Sound Company's system. In many years of trial and error a technique has been developed for laying and raising these cables where length and depth of water are too great for the ordinary method of letting the cable roll over the edge of a scow and the continuous or trans-oceanic type of cableship and machinery are necessary. The cable for this installation was 4.38 in. in diameter, weighed 15.4 lb. per foot and came in one 22,000-ft. length. With water up to 840 ft. deep in the channel, many problems of tension and control were involved.

Recent expansion at the U. S. Navy Yard at Bremerton included increasing the steam generating capacity to 18,000 kw. and the installation of a second 66-kv. interconnection with the company of 15,000-kw. capacity. The influx of employees has increased other load in Bremerton and environs. On account of the importance of service continuity, it was necessary to provide complete duplication of transmission facilities from Bremerton back to the main system, and additional capacity was also needed. In order to provide the necessary reinforcement and duplication of facilities, a second 3-mile, 55-kv. line was built on the mainland from the trunk line connected to Richmond Beach, a second 66-kv. line 24 miles long was built on the peninsula from President Point direct to Bremerton and the substation capacity on each side was increased from 15,000 kw. to 30,000 kw. On December 12, 1940, a third 15-kv. submarine cable was laid across the channel, completing the project.

The new cable is three-conductor, 250,000-circ.mil, non-leaded type, with 29/64-in. Okolite rubber insulation, No. 4 steel wire armor and a saturated jute wrapping over the armor. It is suitable for operation at 15,000 volts delta, or 23,000 volts star, grounded neutral, and will be operated at present on the same 15-kv. bus with the two other cables. This bus is provided with a star-connected grounding bank and each cable is protected with balanced over-current and ground relays.

Corona Control

To eliminate corona cutting and also to utilize the full water-cooled capacity of the submarine cable, three single-conductor, 600,000-circ.-mil, shielded, lead-covered shore-end cables with the same insulation are spliced on each end of the three-conductor submarine cable at a point below low tide. These shore-end cables are laid in a trench and covered with split concrete tile and are taken up the beach and to the substation structure, where they terminate in 35-kv., single-conductor potheads. A full load rating of 15,000 kva. has been assigned to the cable by the company at 15-kv. operating voltage, based on load-temperature test runs under the operating conditions in effect. With the third cable in operation, a total cable capacity of 45,000



FAIRWAY SHEAVES on stern, where cable leaves the ship (left). View at right shows cable-winding machine on upper deck, looking forward. Driving engine for lifting cable is connected through the gear reduction at right. Brake drums and operating position are at left

kva. is provided for this crossing, or 30,000 kva. protected with one complete spare unit. At the substations the 30,000 kva. capacity is also protected with spare transformer units. Step regulation at the President Point substation provides voltage control.

On this cable all splicing was done at the factory at the time of manufacture and before armoring. Under inspection supervision by the Electrical Testing Laboratories, a single 22,000-ft. length of cable was made up, tested and loaded in a string of four gondola cars. These cars were boarded over and chained together and the cable carried over from one car to the next. The trip from Passaic, N. J., to Seattle was made without difficulty, and on arrival the cable was given a rated voltage test before being unloaded.

The company's submarine cableship, the *Wm. Nottingham*, is a former four-masted schooner of 1,380 net tons, 211 ft. long, which had sailed the seven seas for many years.

Cable in Well

The four-car train was shunted along a spur track parallel to the wharf and the 175-ton cargo of cable passed over sheaves suspended from cargo booms through the steam-driven cable winding machine and down the hatch into the forward cable well. The entire 22,000-ft. length of cable was carefully coiled in this well, which is about 35 ft. in diameter and 20 ft. deep, placing plank strips between the coiled layers. After keeping a weather eye on the barometer and reports from aircraft, December 12 was selected for the job of laying.

The ship was handled by Foss Company tugboats, with a 750-hp. tug lashed alongside the stern on the starboard side and a 500-hp. tug on a hawser line ahead. On account of the possibility of stormy weather at this time of the year, a 150-hp. tug stood by and assisted in the maneuvers in getting off the cable ends.

Two 90-ft. scows had been previously anchored off shore, one on each side of the channel, for handling the cable ends. The cable was brought up from the well of the ship and threaded through the cable-winding machine and dynamometer and over the stern fairway sheave into the water. The end was then pulled aboard the scow on the Richmond Beach side and made fast. At 9:40 a.m., when all was in readiness and the tide was right, the ship got under way, controlling the paying out of cable with the brakes on the cable-winding machine.

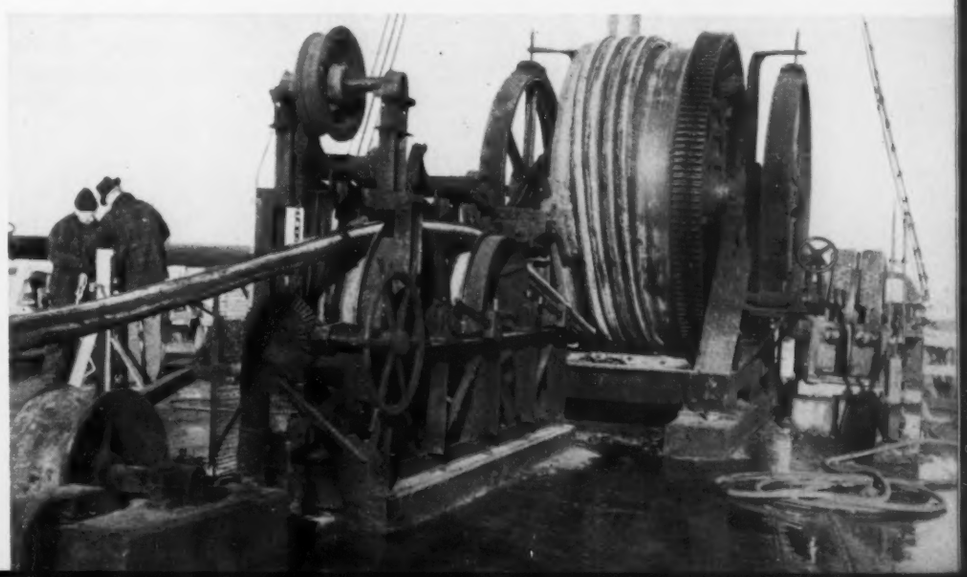
At 11:15 a.m. the ship completed the 4-mile cable-laying trip and dropped anchor alongside the anchored scow on the President Point side. Extra cable was coiled on the scow, to be pulled off with a winch line and spliced to the shore-end cables on the beach.

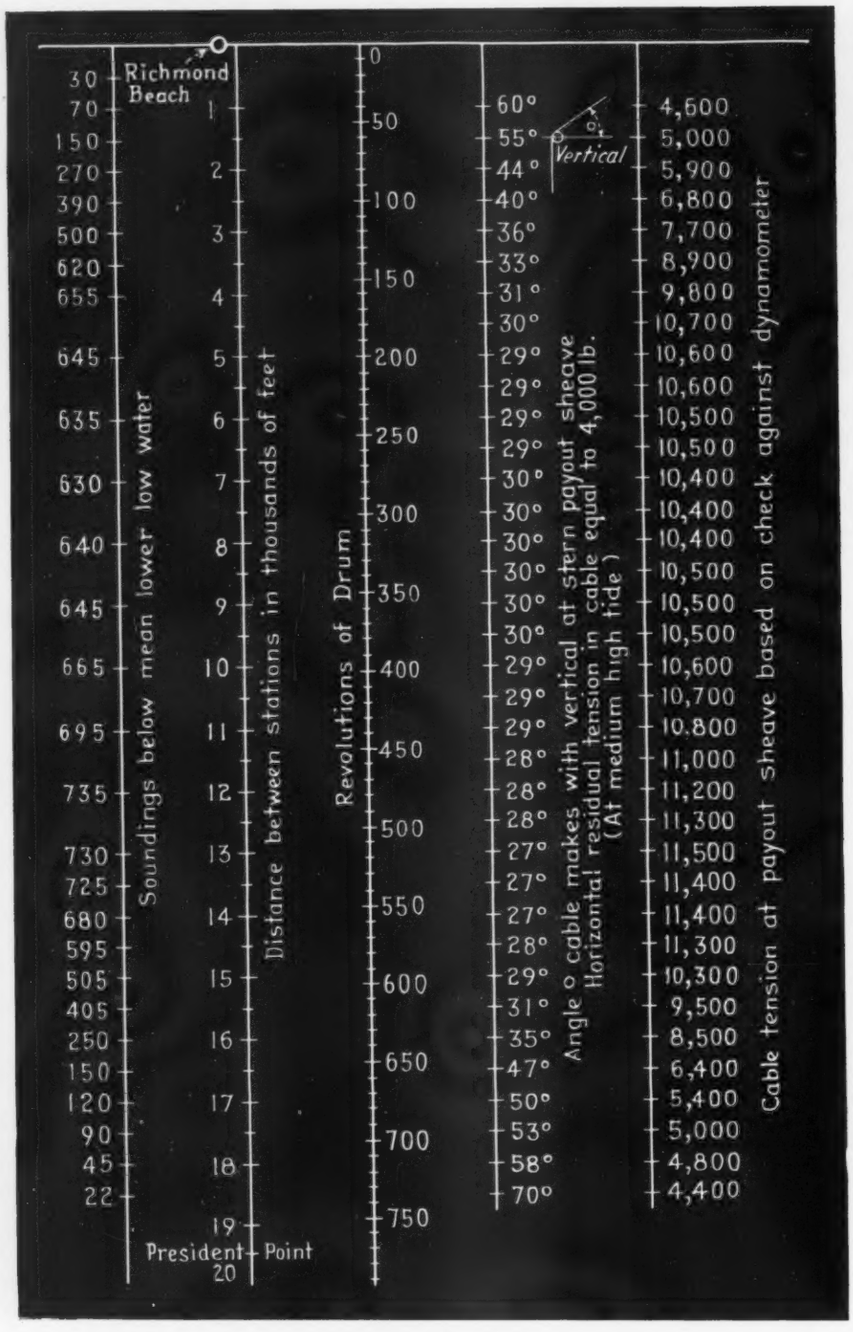
Winding Machine

The cable-winding machine is similar in design to the equipment on cableships used to lay and lift trans-oceanic telegraph cables. The main winding drum, around which several turns of the cable are wrapped for snubbing, is 92 in. in diameter with a 36-in. face. A 150-hp., two-cylinder steam-driving engine on one side and braking equipment on the other are connected to the main drum through gear reductions, and two additional brakes are direct connected on each side of the main drum shaft.

Cable wraps on the main drum are kept tight by passing the cable over two grooved tension sheaves with brakes, mounted on a carriage back of the winder, and also by the lift

THIS TENSION-SHEAVE CARRIAGE, back of the cable winder, keeps the cable tight, away from the drum, during both laying and raising





SCHEDULE of laying data—Tension $I = \frac{WL^2}{8S} + WS = 4{,}000$ **lb.** $+ WS$.

Cable weighs 10 lb. per foot in water

of about 25 ft. of cable coming up from the well in the hold. A small steam winch with grooved pulley is mounted on the upper deck to assist in this lift where necessary, such as in shallow water or when passing cable from one well to another for inspection and repair. When lifting cable, the tension sheaves are driven at a higher periphery speed than that of the main drum and take the cable away fast enough to avoid slippage. Roller bearing fleeting knives on each side push the turns of cable across the face of the drum as it winds over. This equipment has been used successfully for both laying and raising of heavy submarine cables for many years, and will handle a cable of any length that can be coiled in the hold of the ship.

Complete intercommunication facilities were provided to insure the continuity and co-ordination of all operations. The conductors of the cable itself were used while it was being laid, for continuous ship-to-shore conversation regarding the ship's position, from transit men on a triangulation base on the beach. This was supplemented by portable short wave radio sets operating on the company's allocated frequency band. Short wave telephone service was also provided on the tugboat frequency band between the various boats, the Coast Guard cutter and shore stations.

On board the cableship a two-way loudspeaker intercommunicating telephone set-up was provided between all operating positions, such as in the cable well, at the winding machine, at the stern fairway sheave and in the pilot house of the main tugboat.

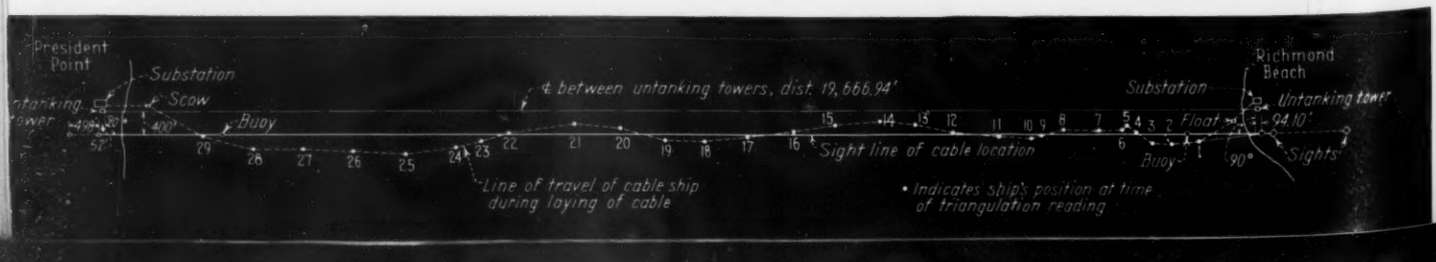
Details Planned

The details of all operations were planned in advance. A location in the channel was selected approximately parallel and 500 ft. south of the previous cable last laid, in order to permit raising the cables for repairs if necessary, without becoming entangled. The ship's course was charted for this location and buoys located at turning points near each shore. To assist in holding the ship on the course and serve in case of loss of communication with the triangulation party on the beach, white targets were mounted on each shore, several hundred feet apart and in line with the course.

A cross-section of the course was obtained from soundings, and computations were then worked out of the correct laying tension and the angle at which the cable should leave the ship's stern at selecting stations 500 ft. apart on the course across the channel, such as would result in a uniform and moderate tension in the cable when at rest on the bottom. Revolutions of the drum as shown on a cycle counter were calibrated in terms of feet of cable paid out.

[*Continued on page 115*]

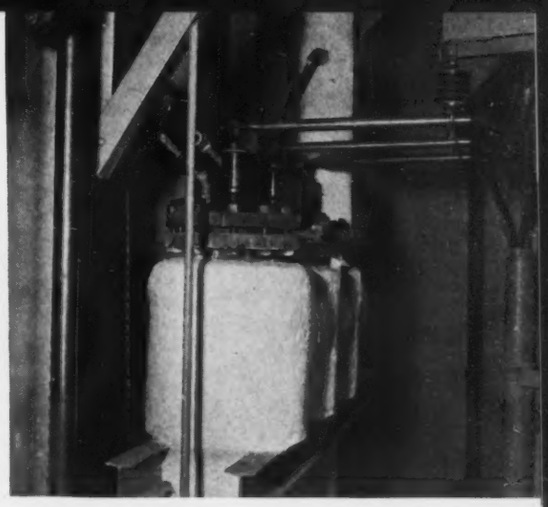
MAP of cable as actually laid



Dump Hydro Keeps Up Standby Plant Steam

Three single-phase electrode heaters maintain boiler pressure at steam standby plant on dump hydro energy, thus saving fuel oil

H. P. CURRIN, Eugene (Ore.) Water Board



THREE single-phase electrode cells provide 350 kw. for maintaining steam standby
Water is taken from the mud drum and discharged into the front upper drum by the vertical pipe at rear. Note external porcelain insulators, grounding connections and venting manifold. Experience has shown the necessity for venting steam pockets at the heater top just under the upper flange—steam deteriorates the porcelain much more rapidly than water does.

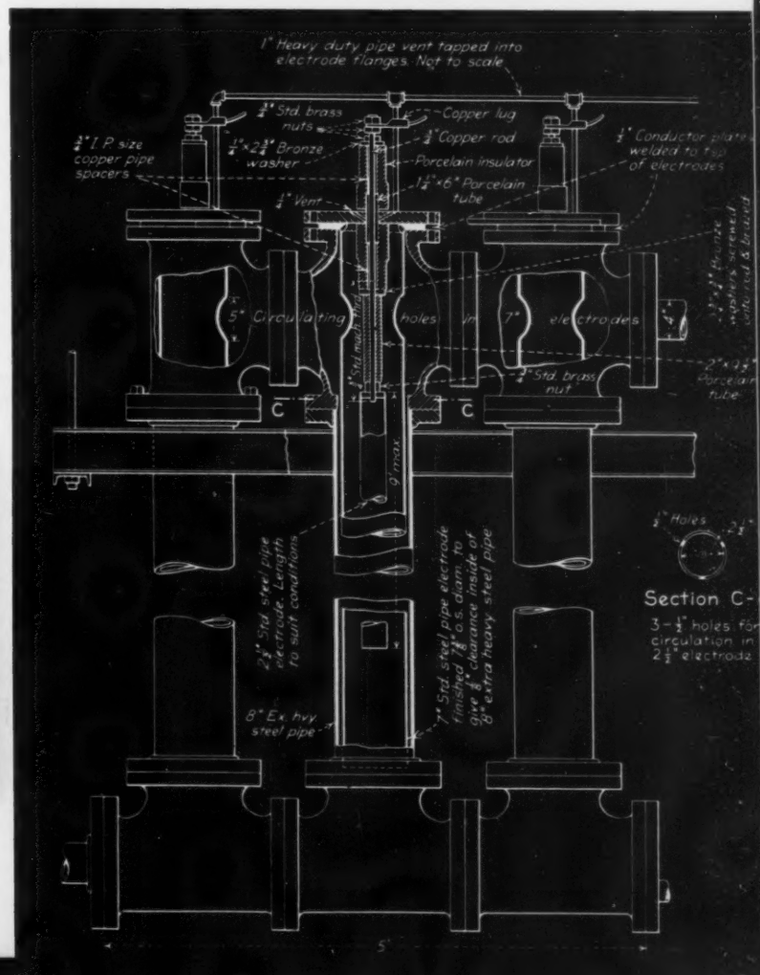
SINCE it went into service, in 1933, a 500-kw. electric heating system used to maintain boiler pressure in a steam standby plant of the municipal electric system at Eugene, Ore., has used 2,600,000 kw.-hr. of dump hydro energy annually, saving an estimated 1,900 bbl. of fuel oil each year. Cost of the installation, which uses electrode-type heaters, was $4,828.

The electric heat for standby is used in a 6,000-kw. plant served by a 250-psi., three-drum, oil-fired, water-tube boiler with 14,130 sq.ft. of heating surface. Radiation losses are 313 kw., but 500 kw. of heating capacity was provided—though only 350 kw. is used—to permit restoration of pressure within reasonable time. Electrode heaters were chosen because of their simplicity and applied to a scheme whereby water is taken from the mud drum, heated and discharged into the front upper drum under normal water level. Three single-phase cells with concentric electrodes are connected as a grounded wye—the outer electrode being grounded—with 332 volts across each cell. Current concentration on the electrodes is held to less than 1 amp. per sq.in., to prevent dissociation of the water.

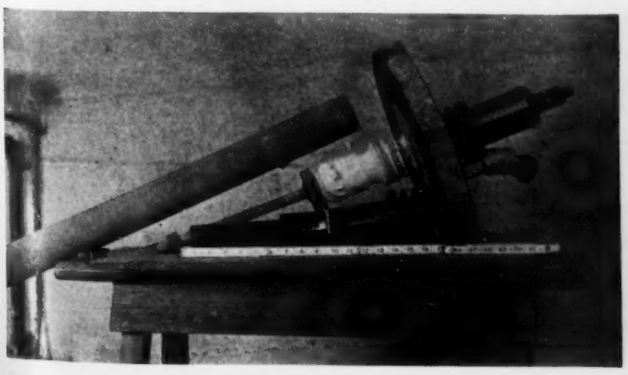
The body of each cell is an 8-in. extra heavy steel casing. A 7-in. standard pipe outer electrode is inserted in this shell. Experience has shown that the sleeve could have been omitted, since no pitting has taken place. The inside electrode consists of a 2½-in. standard steel pipe, 68 in. long.

To establish the power-consuming rate, lime content of the water was adjusted until input reached 350 kw. with all three cells connected. In operation, one cell is cut out when boiler pressure reaches 248 psi., leaving two cells in series across one side of a 575-volt triangle and thus reducing input by one-half. The third cell cuts in again when pressure drops to 225 lb.

ELECTRIC water heater for steam plant boiler


1" Heavy duty pipe vent tapped into electrode flanges. Not to scale
¾" Std. brass nuts
Copper lug
¾" Copper rod
¼"×2¾" Bronze washer
Porcelain insulator
1¼"×6" Porcelain tube
¾" I.P. size copper pipe spacers
¼" Conductor plate welded to top of electrodes
¾" Vent
5" Circulating holes in 7" electrodes
¾" Std. brass nut
2"×12" Porcelain tube
C
C
9" max.
2½" Std. steel pipe electrode. Length to suit conditions
7" Std. steel pipe electrode finished to 6⅞" o.s. diam. to give ⅛" clearance inside of 8" extra heavy steel pipe
8" Ex. hvy steel pipe
¾" Holes
Section C-
3-¾" holes for circulation in 2½" electrode

INSIDE electrode assembly consists of upper flange, porcelain insulator, conducting and electrode-supporting rod of tobin bronze and 2½-in. inside electrode
New inside bushing insulator and protective tube are shown in foreground; the condition of the old insulator is typical for four months' service, although this particular one lasted ten months. Experience with various types of porcelain indicates that best service is obtained from a glaze containing a low percentage of silicon; heat-resisting glass did not prove satisfactory.



Railway Catenary Bridges Carry Utility 66-Kv. Tie—I

Two 25,000-kva. circuits of United Illuminating Company run on New Haven Road electrification structures with mutual benefit to both parties

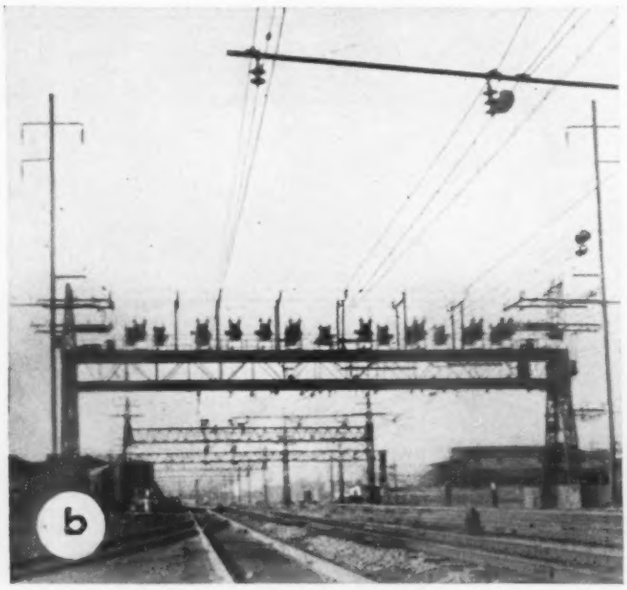
The Power Company's Part

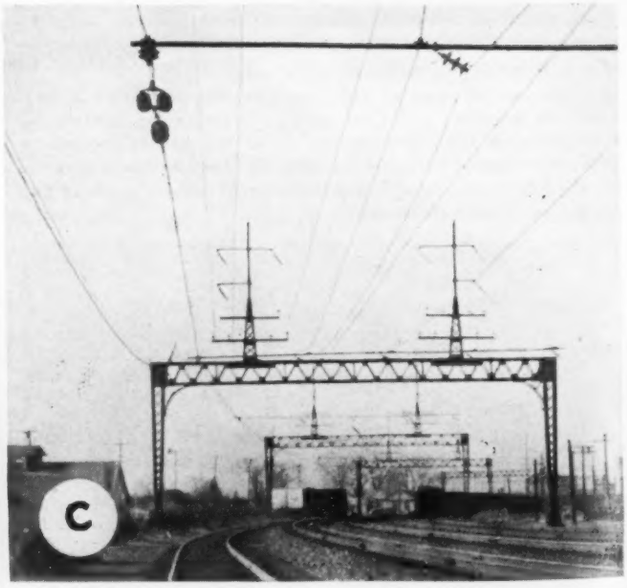
C. A. WILLIAMS & R. H. VAN HORN,* United Illuminating Company*

THE United Illuminating Company has erected two 25,000-kva., 66-kv. open-wire circuits on the New Haven Railroad's catenary support structures between Bridgeport and New Haven as a means of connecting electrically its two generating stations in the two cities not previously connected. A simple contract has been entered into by the two parties for an arrangement which promises to prove mutually beneficial.

For several years the electric company had studied various plans for constructing such a tie-line, to connect the 75,000 kw. of turbine capacity of English station (New Haven) with the 85,000 kw. in Steel Point station (Bridgeport). The prime purpose of the tie is to make available, for the entire area served by the company, the reserve generat-

*Vice-president.



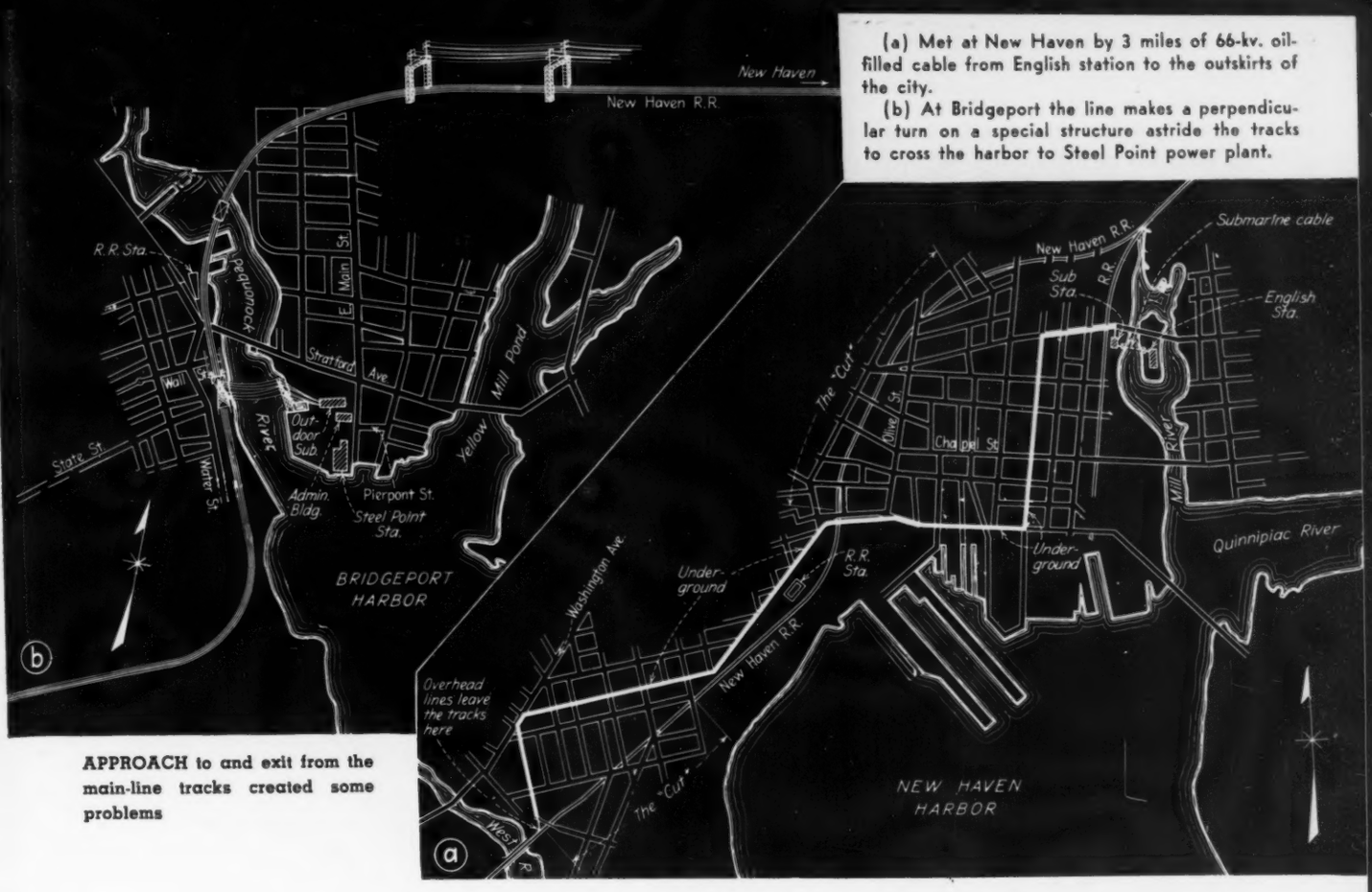


TYPICAL STRUCTURES of the railroad's electrification involved in the rental to power company for two 66-kv. circuits

(a) A tangent bridge type of construction on curve.

(b) A breaker and sectionalizing bridge made separate structures desirable for the two power circuits.

(c) Inset construction where railroad right-of-way is narrow.



(a) Met at New Haven by 3 miles of 66-kv. oil-filled cable from English station to the outskirts of the city.

(b) At Bridgeport the line makes a perpendicular turn on a special structure astride the tracks to cross the harbor to Steel Point power plant.

APPROACH to and exit from the main-line tracks created some problems

ing capacity carried at either station. Correlative advantages are better load protection for both cities under emergency conditions and, to some extent, the possibility of economies of base-load operation.

The route selected, for reasons of cost and ease of construction and maintenance, is the 11-kv. electrified four-track line of the New Haven Railroad. Gibbs & Hill, Inc., were commissioned to study the proposed tie line and report on feasibility and cost of erection. It was quickly ascertained that much of the railroad right-of-way was too narrow to permit a separate tower line, but that extensions to the catenary supports could support the line except at certain points.

Problems of the Route

Each generating station is close to the railroad, but neither is directly adjacent. At Bridgeport the Steel Point station is across the Pequonnock River (upper reach of the harbor) from the railroad, a stretch readily spanned by high tower construction. English station in New Haven is close to a spur freight line, but the difficulties of overhead construction through the station yards in New Haven and through two "cuts," where the railroad passes under several business streets, led to the decision to install some three miles of 66-kv. oil-filled cable from English station to a point on the outskirts of New Haven before going upon the railroad structures.

The cost of going overhead for the 2.65 miles on 52 structures through "The Cut" was estimated to be about 23 per cent of the estimated total for the entire line of 19.75 miles. The cost of the alternative 3 miles of 66-kv. oil-filled cable in New Haven brought the ultimate total for the line about 22 per cent higher than the cost of an all-overhead route. This greater expenditure was made in the interest of reliable service, the avoidance of the hazards of an exposed line through a badly congested area, and was in great measure offset by a lower rental charge for the use of less railroad property.

At Devon, in the town of Milford, the line passes the Devon plant of the Connecticut Light & Power Company, where provision will be made for an emergency connection between the two systems.

Between Bridgeport and New Haven there is 16.75 miles of railroad electrification which has structures already carrying 23-kv. railroad power feeders and 11-kv. signal feeders in addition to the catenary traction conductors.

The type of construction recommended by Gibbs & Hill, Inc., was to insert an H-section extension into each bonnet, which is either an extension of the side column of the railroad catenary bridge or is mounted in between on the bridge cross-member. Two cross-arms erected on these H-section extensions and three six-unit strings (seven at strain points) of porcelain disk insulators support the conductors. An alternative type of construction was considered which consisted of combination pin-post insulators mounted on steel crossarms, but this type of construction was discarded because the impulse strength of the insulator was 18 per cent less than that of the suspension units and because the pin-post stack was 33 in. high and presented some structural weaknesses. A possible saving by using this alternative construction was offset by the greater impulse strength and reliability of the suspension type of construction.

Columns Extended

In order to obtain the necessary clearance for suspension construction, it was recommended that no effort be made to use the available crossarm

space, but that H-section extensions be installed in all the bonnets. This type of construction would permit the two circuits to be erected on opposite sides of the track. In cases where these extensions were placed on the bridge itself, rather than on the columns, the under chord of the cross-member of the catenary bridge was reinforced by rods and turnbuckles. Fifty of the 81 bridges on curves called for the installation of guys and anchors.

Highway Crossings

At eleven passes beneath highway bridges the two lines could be carried on extensions of the existing transmission poles erected by the railroad to clear highway traffic and other utility circuits. Such towers could be reinforced by additional guys to carry the added power circuits. Between New Haven and Bridgeport there are six anchor catenary bridges, so encumbered with railroad transformers and protective equipment that the circumstances dictated separate structures at these points for the power company circuits. Generally, except at these points, at the take-off for the Bridgeport harbor crossing and at the New Haven terminal, the two overhead circuits would be entirely on railroad supports.

One favorable factor from the standpoint of reliable operation through lightning storms was the thorough grounding of the railroad's structures. All the catenary bridges are tied together by two ground wires and the four ¾-in. steel catenary messengers, and these are all connected to track impedance bonds at about 1-mile intervals and cross-bonded for all four tracks. This was considered by the consultants to lower the impulse impedance to a point where no further ground connections would be necessary. A No. 4/0 copper ground wire was to be installed over each 66-kv. circuit for overhead shielding.

Each power circuit has three complete barrel transpositions.

The Contract

With these points pretty well established by the survey, negotiations were started for a contract which was executed between the United Illuminating Company and the trustees of the New Haven Railroad in May, 1940. It is in simple form and provides for the installation and ownership of the structures and lines, and for a fixed rental for the rights granted. Its tone typifies the feasibility and mutual advantages of having the power line on the railroad right-of-way and structures. The term is 20 years, with privilege of renewal by the power company for an equal term. The power company is further privileged to terminate at the end of ten years on three years' notice.

It is stipulated that mutual interest of both parties demands uninterrupted and safe public service and that each must minimize any interference or interruption of the other's facilities.

All the structures and structural additions are to be erected at the expense of the power company, but they are at all times under the supervision of the railroad. The railroad provides inspection and patrol of the tie line and will maintain and repair the transmission circuits at the power company's expense. Any cost of altering telephone, telegraph and signal facilities to accommodate the power circuits or overcome interference is borne by the power company.

The title to hangers, hardware, insulators and transmission conductors remains in the power company and the power company guarantees to remove them if, as and when the joint use is terminated. Ownership of all additions to the catenary support structures is transferred to the railroad immediately upon erection.

It was stipulated in the contract that Gibbs & Hill had been retained by the power company to design and construct the circuits.

The Railroad's Part

SIDNEY WITHINGTON, New York, New Haven & Hartford Railroad*

ROUTING of transmission lines, especially in urban or suburban territory, may be for obvious reasons somewhat difficult, and it is not unnatural to consider existing railroad rights-of-way as possible solutions of the problem. If the railroad is electrified, and if the traction-power supporting structures are readily adapted to modification in order to carry additional power circuits, the joint use of the facilities may be even more favorable economically. In a number of instances power lines have thus been located on railroad property with advantage to the power company in economy of installation, and also to the railroad, which receives revenue in return for increasing the intensity of use of its facilities.

A number of important considerations, however, from the viewpoint of both the railroad and the power company must be carefully analyzed. For example, the railroad right-of-way is often fundamentally less suited to the exacting requirements of commercial power service than would be an exclusive right-of-way. Crowded conditions often exist on railroad rights-of-way and the possibility of trouble due to adjacent fires or to derailments or other railroad operating contingencies must be considered. The power company must thus expect to face certain problems which it would not expect on its own exclusive right-of-way. The railroad also, in sharing its facilities with the power company, must be prepared to accept problems which it would otherwise not have, on account of the presence of the power company circuits above its facilities. The revision of railroad structures to carry loads for which they were not originally designed may involve certain compromises, resulting in features less advantageous than would be the case if the structures had been originally designed as a whole for the ultimate load.

Reciprocal Benefits

In analyzing such occupancy of railroad property sufficient over-all economic advantages should be available to justify the power company in paying to the railroad a revenue substantial enough in turn to justify the railroad in sharing its property and accepting the inconveniences and hazards on account of the presence of the commercial circuits.

The railroad has in this project certain space on its catenary structures which can be made available for

*Electrical engineer.

use by the power company on the assumption that the railroad will not need the space for developing its own power facilities during the term of the occupancy by the power company circuits. In figuring the proper return for the occupancy, the prorated value of the real estate—partly urban, partly suburban and partly rural—and of the railroad electrification structures, including five high river-crossing towers, has been carefully analyzed and an arrangement which is considered fair and satisfactory to both companies arrived at.

Satisfactory Line Supports

As has been indicated, the railroad catenary structures lend themselves to the extension and reinforcement necessary for the added power circuits. The new 66-kv. conductors are installed in general directly above the railroad feeders, usually at either end of each catenary bridge, and are of the same size and material as are the railroad feeders, and thus have the same sags and stresses and other mechanical characteristics. Careful analysis of structural steel stresses, as well as the stresses in the conductor themselves and in the supporting insulators, insures, so far as is reasonably possible, against mechanical or electrical failure. Ground conductors above the feeders of both circuits serve as metallic return in the event of ground faults, and also as lightning protection. Since the structures are electrically connected to the track rails at intervals, there is what amounts to an effective "counterpoise" as additional protection against lightning.

Especial consideration is necessary in co-ordination of inductive effects with railroad signal and communication facilities, since the 66-kv. circuits are parallel and in close proximity to these circuits. The railroad communication circuits are carried in a lead-sheath cable, partly overhead on wood or steel poles and partly (where the right-of-way is restricted) underground in ducts. The inductive effects of the railroad's own traction circuits had made necessary certain grades of insulation in the communication cable, and other protection, so that the only added protection which will in all probability be necessary on account of the 66-kv. circuits will be the installation of a No. 4/0 copper shielding conductor close to the communication cable on the poles and connected to the rails at intervals. The 66-kv. circuits are of course transposed at intervals as an added co-ordinative measure.

The signal system of the railroad is a nominally 60-cycle system and is thus of a frequency close to that of the paralleling commercial power circuits. Since the rail circuits which actuate the signal relays are of relatively low voltage and current magnitudes, it is necessary to insure that there shall not be under any condition interference which would cause false signal operation, not only on account of stray ground or rail currents from the commercial circuits, but also on account of currents which may be induced in the rails by short circuits or other abnormal conditions. In order to effect this, the frequency of the railroad signal system will be slightly modified by means of frequency-changers, so there will be no chance of synchronization with commercial circuits and, in addition to this, there will be installed at each signal or cut-section location on the railroad an additional frequency-relay which will not feed 60-cycle power back from the rails into the track relays, but if such power should be present for any reason, these auxiliary relay contacts will open.

Safe Erection

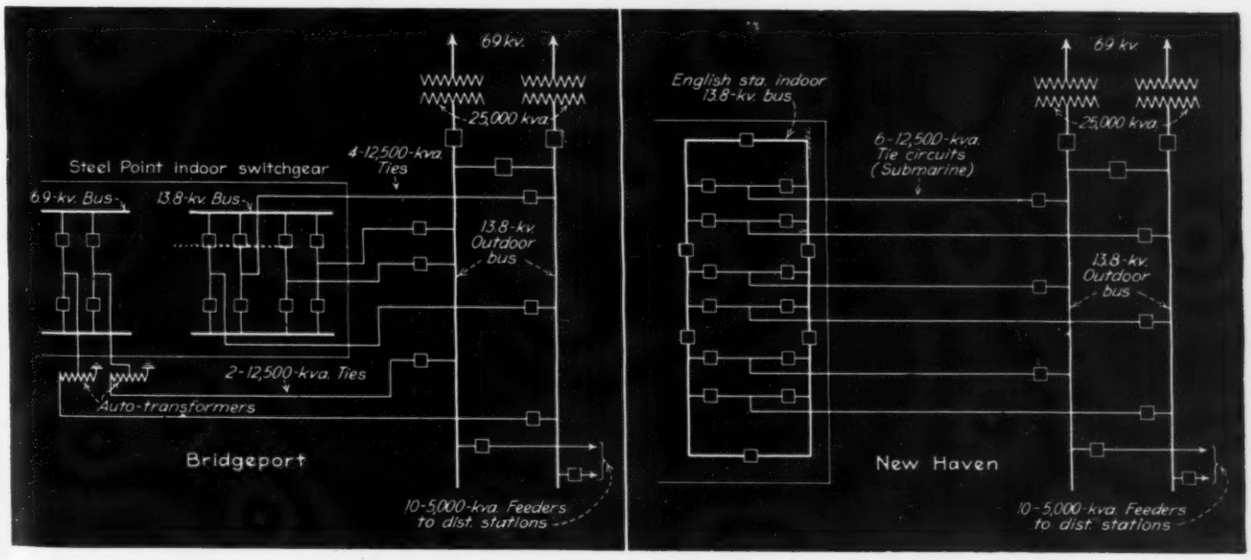
Serious attention was necessary in connection with methods of installation,† since the construction was accomplished adjacent to a very busy high-speed railroad. While minimum interference to train operation was of course vitally important, *safety*, both to train operation and to construction forces themselves, was the paramount consideration. This was of especial concern where installation was carried on in close proximity to the railroad traction circuits which could not readily be deenergized. Elaborate provisions were thus necessary, and in some cases considerable temporary construction.

Maintenance

The railroad maintenance organization can readily patrol or inspect the commercial circuits from work trains simultaneously with the patrolling or inspection of the railroad's own power distribution system, and with-

[*Continued on page 50*]

†To be treated in an ensuing article.



EACH of two circuits at each end provides ten feeders direct to substations as well as ties into station buses

Modern Load Cycles Warrant New Transformer Characteristics

Regulation, overload rating, surge strength, weight and size improvable by resort to changed loss-ratio design based on use of sheet capable of higher flux density

W. A. SUMNER,* Westinghouse Electric & Manufacturing Company, Sharon, Pa.

IN MODERN small distribution transformer design attention is being given to tailoring their over-all performance characteristics more closely to the load factors and load cycles actually being experienced on distribution circuits. Fitting the performance in the best way to the typical cycle is primarily a matter of best compromise of copper-to-iron loss ratio, of reactance and impedance and of thermal properties. Modern loads call for a transformer with reduced proportion of copper loss. It happens that the design factors and materials which make such a change feasible also afford gains in the direction of impedance, surge strength, overload capacity, weight and size.

Short Time Overload

For many years the rating has been defined as the continuous load which could be carried without exceeding a 55 deg. C. winding rise. In the smaller units, such as 10 kva. and below, the container provides an excessive amount of radiating surface so that the 55 deg. C. rise cannot be reached. From 15 to 25 kva. the proportions are such that a normal plain wall tank design will produce just about the allowed temperature rise; for larger transformers auxiliary radiating surface in the form of corrugations or cooling tubes is required to prevent such transformers exceeding the guaranteed rise on continuous load.

At all events, short-time overload capacity is available in a greater or less degree throughout the entire range. This is a fortunate condition inasmuch as the vast majority of distribution transformers are heavily loaded for only comparatively short periods. Taking advantage of this situation in determining the connected load to be placed on the individual transformers is known as loading by copper temperature. Herein lies true economy to the operating company as full advantage is taken of the inherent characteristics of the transformer and a considerable saving in initial investment is effected.

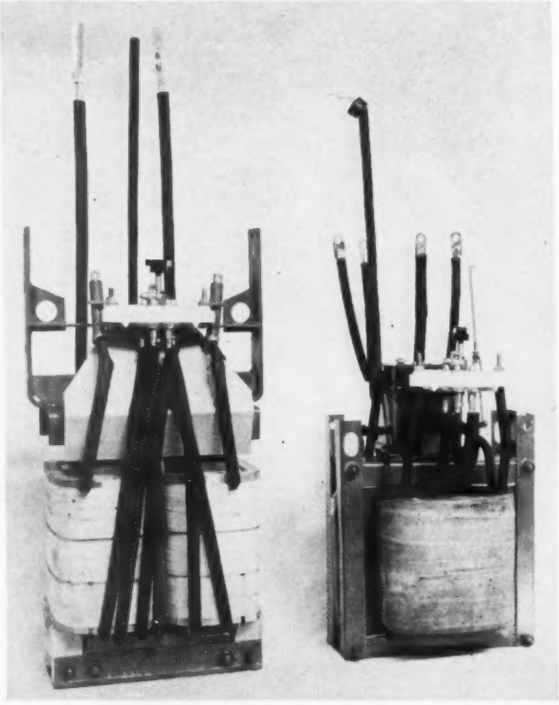


FIG. 1—PRONOUNCED reduction in size obtainable in transformer design employing modern electrical sheet for core

Modern Loading

This method of loading has increased in favor until now most operators employ it in some form. Because of this, transformer manufacturers and designers are universally giving attention to the factors which will make such operation most successful.

In approaching this problem from the design standpoint, it is logical to start with the thermal characteristics. The winding rise at any time is the summation of the oil rise plus the winding gradient. The final oil rise is proportional to the total loss raised to a power varying with different designs from approximately 0.8 to 1.0. The total loss consists of the iron loss which is independent of load and the copper loss which is proportional to the square of the load. The coil gradient is caused by the copper loss and is proportional to the load raised to a power varying from 1.6 to 2.0. Since coil gradient varies so rapidly with load, it can be seen that the full load gradient must be relatively low.

*Transformer engineering.

This can be controlled by the proportions of the coil and the use of coil-ventilating ducts. To do this, of course, adds to the mean turn of copper.

Surge Strength

However, during recent years two developments have indirectly assisted the designer in producing a transformer with improved thermal characteristics without excessive cost. The first of these has been the increased knowledge of surge phenomena gained through the use of the modern impulse generator and cathode-ray oscillograph. This, together with improved methods of processing, has permitted a higher copper space factor in the iron opening or window without sacrifice in surge strength through a more scientific application of insulation and processing. The second development is the continued improvements in electrical sheet steel which has permitted the use of higher densities without excessive iron losses. Both of these developments have tended toward greater economy of active material and hence more liberal cooling ducts can be added without seriously affecting the cost.

Loss Level

As shown above, the losses figure in the temperature rise so that they must receive consideration also. To arrive at the actual values of losses is a difficult problem. This subject has been given much study in recent years. In general, the performance level of distribution transformers is quite comparable among the different manufacturers and appears to be generally satisfactory. However, some utility engineers have felt that, in the interest of lower first cost, the losses should be increased. The cost of the active materials is an inverse function of the product of the losses. Savings in first cost would therefore result, but this would be offset by an increase in the cost of supplying the losses. Other things being equal, the temperature rise would be higher, so that these transformers would not fit the distribution cycle curve as well. In the larger sizes, such as 15 kva. and above, where the normal design approaches a 55 deg. C. rise, the design with the increased product would probably require a larger tank with more radiating surface and more oil, so that the full savings in active material would not be realized.

To improve the product of losses, while a help in fitting the transformer to the load cycle, would undoubtedly be unsatisfactory to most users as it would increase the first cost of the transformer.

Loss Ratio

There is a way of adapting the losses better to the average load cycle, however, without affecting to any extent the first cost of the transformer. This is accomplished by maintaining existing products of losses essentially at their present value, but changing the ratio of the copper to the iron loss. Several years ago this could not very well be proposed. Now, with the greater use of domestic appliances, load factors have in general improved to such an extent that lower copper losses accompanied by higher iron loss will not raise the cost of operation. The copper loss is the larger of the two losses. Therefore, if it is reduced by the same percentage by which the iron loss is raised, the total loss will be reduced. Hence, with other things being the same, the oil rise, and consequently the coil rise, will be lowered.

The above has suggested means of fitting the transformer better thermally to actual load cycles. The increased short-time rating thus made available cannot be utilized, however, if the regulation becomes too high. Therefore, the *IR* drop must be small to maintain satisfactory regulation at 100 per cent p.f. The lower copper loss advocated above will, of course, take care of this condition. However, most installations now include motors so that normal power factors will be appreciably lower than unity. Consequently the *IX* drop must be held to a low value. Here again the high-grade electrical sheet steels now available* assist in this problem. As stated above, it is possible to work this material at higher density than the older grades. Other things being equal, this results in a reduction of the number of turns—an effective means of reducing the react-

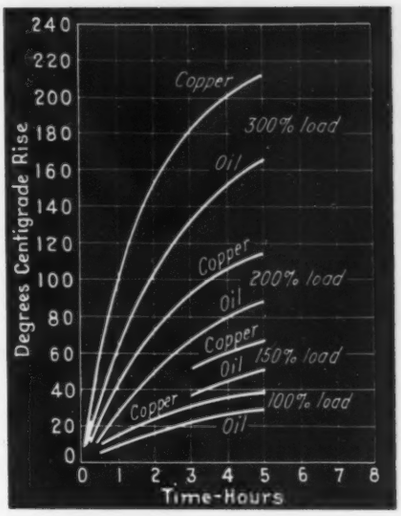


FIG. 2—TYPICAL transformer temperature rises obtained at various loads with design aimed at low gradient

*Characteristics of the new sheets are detailed in this issue of "Electrical World" on page 86.

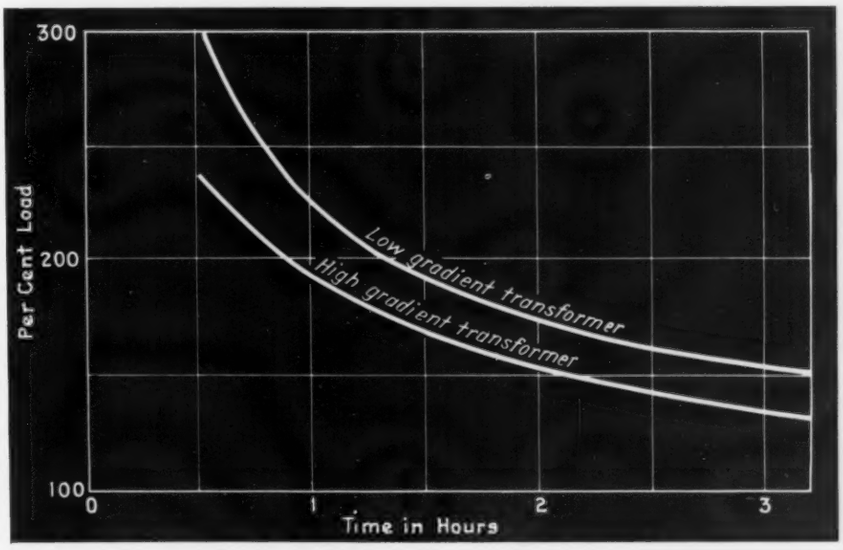


FIG. 3—COMPARATIVE load-time performance for transformers with low and high temperature gradients

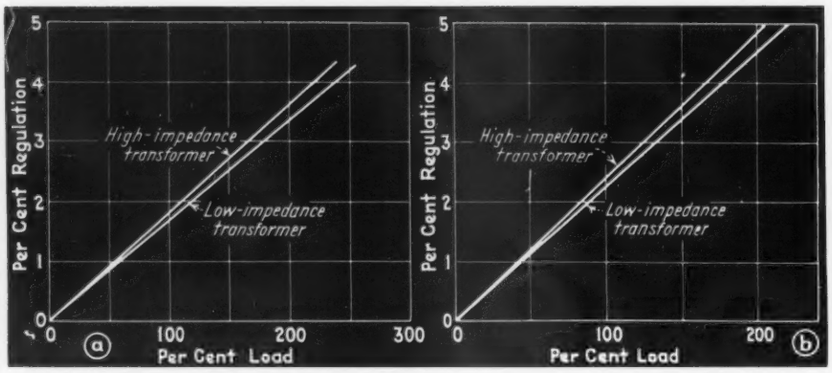


FIG. 4—COMPARATIVE regulation characteristics of transformers designed for low or high impedance—(a) At 100 per cent p.f. (b) At 80 per cent p.f. lagging

ance. Therefore, the suggested changes make it possible to serve the larger loads available thermally at satisfactory terminal voltages.

High-Density Iron

Reference has been made several times to the modern designs using the latest grades of high-quality electrical sheet steel. Such designs invariably are accompanied by marked reduction in size and weight. A typical example is shown in Fig. 1, which illustrates a modern design of a 15-kva., 7,200-volt transformer compared with the more bulky design used for the past few years. Both have the same product of losses. In these new designs reductions in net weight, including oil, average approximately 20 per cent, a further contribution to improved over-all system operation arising through the greater ease and smaller expense in installation. In most cases the reduced dimensions of core and coil permit the use of a smaller diameter tank. In such cases the radiating surface is smaller than in older designs, and in spite of the lower total loss the oil rise at 100 per cent load may be higher than in the superseded design. However, with the lower coil gradient the winding rise may be expected to be approximately the same as before, and on overloads, with the total loss and gradient smaller, the total winding rise will also be lower as desired. In designs where the reduction in size of core and coil is not great enough to mount the transformer in the manufacturer's next smaller standard tank the winding rise should be smaller for all loads.

Comparative Analysis

As a concrete example let us take a 10-kva., 2,400-120/240-volt transformer having a loss product of 10,738 with a ratio of losses of 3.09. This gives an iron loss of 59 and a copper loss of 182. Now let us, for example, raise the iron loss approximately 10 per cent and lower the copper loss approximately 10 per cent. This will give us an iron loss of 65 and copper loss of 165 with essentially the same product of losses; *i.e.*, 10,725 and a loss ratio of 2.54. From these loss figures operators may make a comparison of the cost of supplying the losses. The selection of losses is largely independent of type of construction. The temperature and reactance characteristics, however, are quite intimately related to the form and proportions of the individual structure. An example of what may be accomplished, however, is shown by the accompanying figures and curves, which are taken from an actual case.

Effect of Loss Ratio on Temperature

10 Kva. 2,400–120/240 Volts

	Prod. Loss	Ratio Loss	100% Load			150% Load			% Regulation	
			Oil Rise	Coil Grad.	Coil Rise	Oil Rise	Coil Grad.	Coil Rise	100% P. F.	80% P. F.
New....	10,725	2.54	37	9	46	64	17	81	1.68	2.24
Old.....	10,738	3.09	30.5	17	47.5	53.5	36.5	90	1.81	2.37

Fig. 2 shows the oil and copper rise curves for the improved modern transformer. From this information and from similar data on the old transformer with the high ratio of losses and high gradient short-time overloads which these two designs can carry without exceeding a rise of 55 deg. C. have been calculated and are shown in Fig. 3. This curve illustrates the better adaptability of the second transformer to distribution load cycles.

Figs. 4a and 4b show the regulation characteristics of these particular designs. From Fig. 4a, showing regulation at 100 per cent p.f., it is seen that with the same terminal voltage an effective increase in rating of approximately 7½ per cent over the older design results because of the improved regulation. From Fig. 4b it is seen that the effective increase in rating for the new design is 5½ per cent. Reference to the thermal characteristics in Fig. 3 shows ample margin for carrying these heavier loads for the short-time peaks.

Figures given in this article should not be assumed to represent any suggested values for standardization. Nor should it be assumed that they represent a fixed relation between the various performance characteristics. In a recently revised line, for example, the average increase in effective rating due to improved regulation at 100 per cent p.f. was 10½ per cent and at 89 per cent p.f. it was 12½ per cent, rather than the figures given in the curves. Coil gradients at 100 per cent continuous load averaged 6 deg. C.

Railway Catenary Bridges Carry Utility 66-Kv. Tie

[*Continued from page 47*]

out additional expense. Under normal conditions the railroad forces may accomplish necessary repairs or specific tests on the commercial circuits at minimum cost, since transportation of men and equipment is readily available. It is thus contemplated that all inspection and maintenance will be accomplished by railroad forces, acting, of course, in continuous and very close co-operation with the power company operators. It is in this phase of the arrangement that the utmost attention to details between the two organizations will be necessary.

Recondition Insulating Oil Economically

Five years' experience gives overall cost of 7 cents per gal.—Method insures high quality product

PROCESS tanks and heaters in transformer repair buildi

ELECTRICAL EQUIPMENT employing insulating oil as a dielectric and cooling medium can perform reliable service only when such oil is a good dielectric. The first step in the deterioration of insulating oil is the formation of organic acids resulting from the oxidation of the unsaturated compounds. This oxidation is stimulated by the presence of foreign matter such as minute particles of oxidized materials, dirt and cotton fibers which absorb oxygen and moisture, and which act as catalysts. Other active catalysts which accelerate the oxidation of insulating oil are copper and cast iron. These organic acids are polymerized into soluble and insoluble compounds upon being subjected to heat and pressure. The nature of the crude from which it is refined and severity of its use affect the time at which deterioration will start.

Replacement Problem

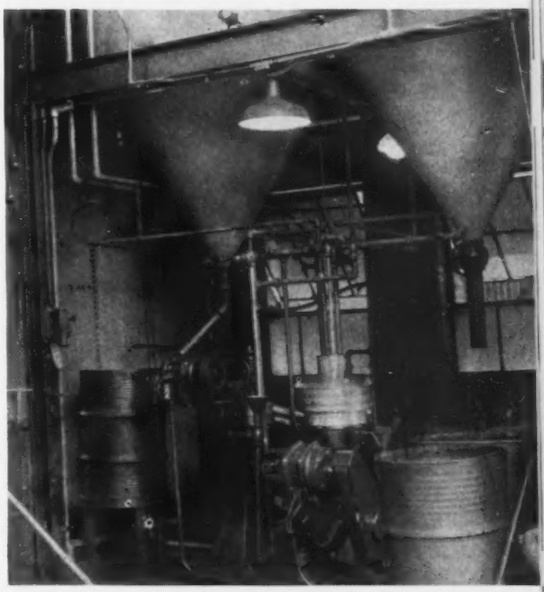
Until recent years it has been the practice to discard, and replace with new, insulating oil which has been shown by test, observation or experience to be unsafe for further use. Inasmuch as tests have not been perfected that will definitely indicate when an insulating oil ceases to offer the proper protection, it becomes necessary to discard it at some arbitrary value of acidity or other test. This procedure is a costly one, as it is necessary to clean the equipment thoroughly to obtain the maximum life from the new oil. This discarded oil is still an excellent material except that it contains, to a small degree, certain impurities, which, if removed, would be equivalent to newly refined oil.

Determination of the practical life of an insulating oil unfortunately cannot be made by laboratory tests, whether they are of the recognized groups or the much publicized accelerated life tests. The ordinary routine tests such as neutralization number, spark, flash, fire, etc., only classify an oil according to these values. They have no significance as to its condition or probable life. "Life tests," because they are accelerated, must be made at temperatures in excess of those in the field and have no practical value.

Because of the uncertainty of the life of an insulating oil it appears logical to assume that if the so-called deteriorated oil could be reconditioned satisfactorily and at a reasonable cost, it would be more economical to consider its replacement before the period of doubt as to its condition exists. This would reduce, if not eliminate, all failures due to sludge deposits and acidity.

The Narragansett Electric Company, Providence, R. I., has spent many years studying this problem, which has resulted in a method of reconditioning insulating oil whereby a product appears having chemical and physical characteristics equal to newly refined oil. Oil reconditioned by this process has been in use for five years and thus far has been giving equal service to new oil. During recent years all distribution trans-

[*Continued on page 54*]

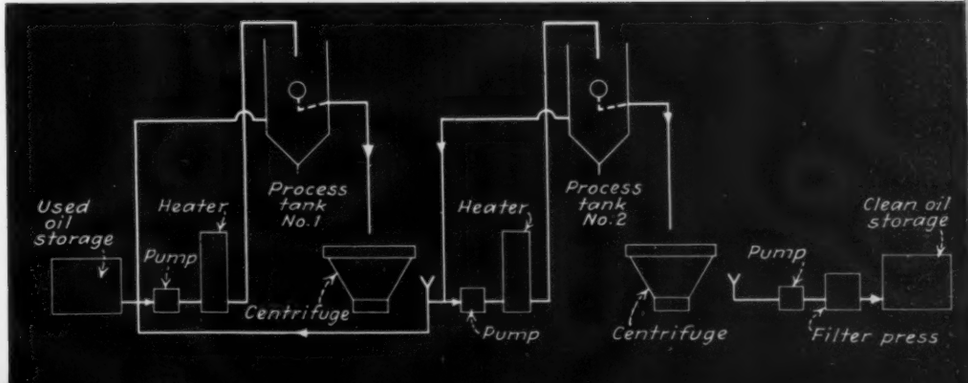


CONICAL bottoms of process tanks and centrifuges

Comparative Analyses of New, Used and Reconditioned Insulating Oil

	Used	New	Reconditioned
Viscosity, Saybolt Universal at 100 deg. F	59	58	57
Flash point, deg. F	274	275	275
Fire point, deg. F	296	298	298
Acidity, Mg.KOH/gr. of oil	0.7 or more	Trace	Trace
A.S.T.M. S.E. (steam emulsion No.—Seconds)	80	20	10
Power factor at 20 deg. C., per cent	1.0	0.20	<0.02
Moisture p.p.m.	60+	50	30
Dielectric strength, kv		26-30	34+

FLOW DIAGRAM of insulating oil conditioning plant



Self-Supporting Overhead Cable Proves Up

Philadelphia Electric installs 4½ miles of messengerless aerial cable in heavily treed area — Snow-laden tree downed it, but it continued to carry load

SAMUEL H. TROXEL, Jr. Philadelphia Electric Company, Ardmore, Pa.*

EXPERIENCE with self-supporting (messengerless) aerial primary cable through heavily treed areas on the Philadelphia Electric Company system has already indicated that it affords:

1. A reliable express radial-circuit service direct to centers of load distribution.
2. Visible and accessible construction at less cost than underground construction and equal reliability.
3. Absence from circuit interruptions originating with separation of conductors in conventional open aerial construction.
4. Freedom from necessity for tree trimming.
5. Cost intermediate between open wires and lead-sheath cable with messenger.
6. Ability to ride through ice and wind storms even though felled with poles by trees.

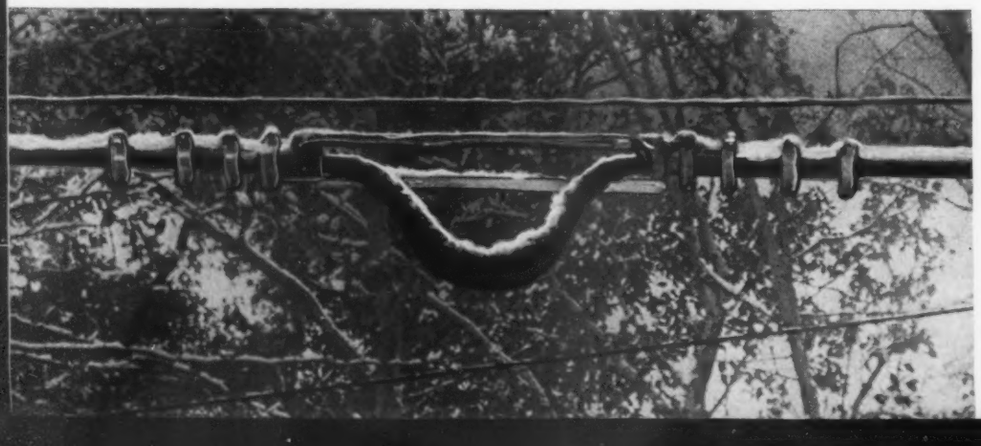
Self-supporting cable, called type S.S. cable, is available in either two or four conductor (the armored sheath being counted as a conductor) from sizes No. 8 to No. 2/0, in voltages up to 7,600 volts to ground (13.2 kv. between conductors), and therefore is applicable to transmission and distribution circuits. The cable's most important use in the past has been on single-phase extensions in suburban and rural areas.

SNOW-LADEN 100-ft. tree brought messengerless cable down, but it continued to carry load. At the left are two telephone cables and at the right two street-light wires

*Engineering assistant, main line division. Paper presented before recent T & D committee meeting of the Pennsylvania Electric Association, Harrisburg, Pa.

In June of 1940 the Philadelphia Electric Company made its initial installation of a four-conductor type S.S. cable when a 1,300-ft., 4 x No. 6, 2,300–4,000-volt rear-property line was run to provide better service conditions and a breakdown primary loop. Along with this installation two-conductor No. 8 type S.S. cable was used to provide for a single-phase feed to transformers located between the terminals. G. S. Van Antwerp, general superintendent, transmission and distribution department, directed the purchasing department to place an order for 15,000 ft. of 4 x No. 2/0 primary S.S. cable of a new type. This cable was to be used for a new substation-circuit and circuit rearrangements in heavily treed areas. The engineering department was of the opinion that if the operations department could do this job successfully at this location, the cable could then be considered applicable to any situation. This installation of more than 4½ miles (23,580 ft.) of 4 x No. 2/0 S.S. cable has been completed and we are proud to say that we can install the cable anywhere.

"MANHOLE-IN-THE-AIR." Splice in the S.S. cable made up in the air between installed, 2,000-ft. factory lengths after the cable has been properly sagged



Description of Cable

Construction of two-conductor S.S. cable consists of a solid or stranded central conductor, surrounded by an insulation wall of varnished cambric, rubber or rubber-like insulation materials. (Philadelphia Electric Company has chosen varnished cambric

Table of Comparative Costs in Per Cent Installation on Existing Poles

Type of Cable	Kva. Capacity	Cable Costs	Installation	Total
2/0 P.L.	100	100	100	100
2/0 S.S.	100	104	55	92

insulation.) Over this insulation is wrapped a rubber and fabric jacket and then alternate circular galvanized 120,000-lb. steel, 0.095-in. in diameter, and rectangular tinned copper wires, 0.08 x 0.04 in., in such a manner that under tension they result in an effective "tongue-and groove interlock" of the entire covering.

The four-conductor cable is similar except that a $\frac{3}{64}$-in. rubber and fabric jacket is placed around the insulated conductors that have been twisted and packed with jute filler. This construction forms a solid circular cross-section for wrapping with the alternate 0.134-in., 120,000-lb. galvanized steel and the 0.120 x 0.060-in. tinned copper wires. "Compact stranded" conductors are used in cable of No. 2 American wire gauge size and larger.

Alterations in construction as planned for the future may be as follows:

1. Replacement of the 120,000-lb. steel with 50,000-lb. steel in the larger conductor cables.

2. Replacement of the alternate galvanized steel and tinned copper wires with uniform size "copper-clad" steel wires.

Electrical Characteristics

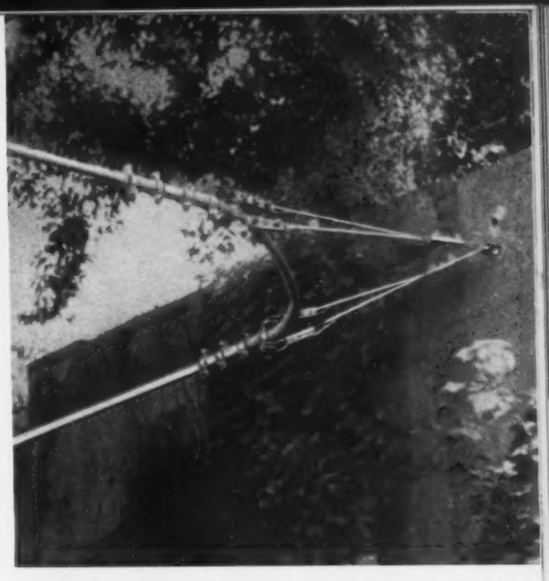
Type S.S. cable greatly reduces inductive interference in telephone circuits and eliminates all radio interference. Better voltage regulation of radial primary circuits is acquired as a result of the low resistance and low impedance ground-return sheath and its close physical spacing with respect to the inner conductors. The dielectric strength of the cable is very high, minimizing the possibility of electrical failure from any cause. The cable will withstand severe strain loads resulting from high winds, ice or mechanical shocks. Because of its peculiar construction, there is no possibility of short circuits or ground faults as a result of foreign contacts. The ground potential of the semi-rigid outer conductor reduces clearance distances, facilitates the joint usage of poles, makes possible the use of shorter poles and prevents interruptions which formerly resulted from lightning storms. The manufacturer maintains that the cable is bullet-proof to the extent of eliminating the failures attributed to the hunting season. Hazard to human life from open wires or wires on the ground following the loss of poles is greatly reduced.

New Hardware Developed

Installation of this cable required the development of new methods and new articles of pole-line hardware, for installing cable dead-ends, splicing, tapping or sectionalizing, and supporting the cable on the pole. For this purpose, cast-steel saddles of the straight and clevis variety, splicing and dead-ending clamps of the "squirrel-cage" and universal type were developed.

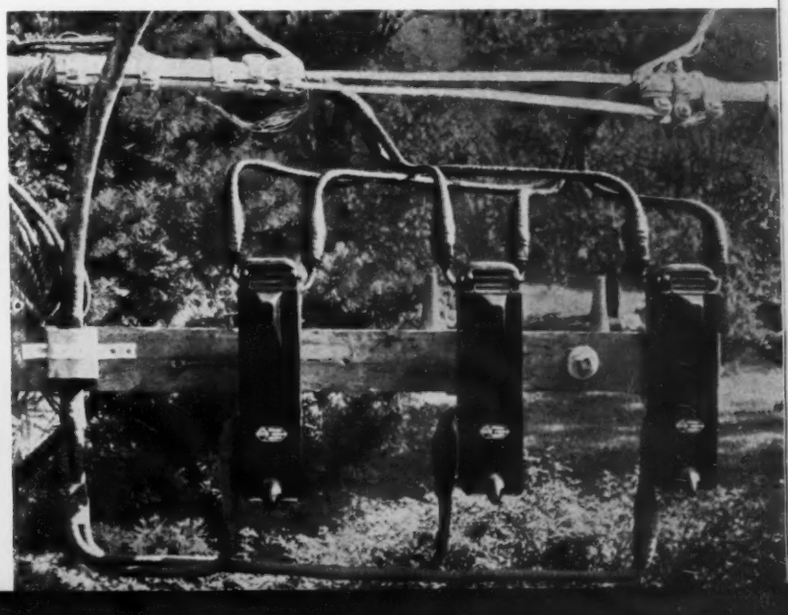
In considering this cable the engineering department and the manufacturer developed cast-steel saddles and a splicing and dead-ending gadget, branded the "squirrel-cage." The cast-steel saddles were found to be satisfactory, but excessive activity in the foundry business as a result of present war conditions made these saddles hard to obtain and contributed to their relatively high cost. It was then decided to fabricate a new saddle, for use on both straight or corner poles and to eliminate the clevis type and cast variety. This revision has eliminated the necessity of stocking two types of saddles and has reduced their cost approximately 50 per cent.

Considerable installation difficulty was experienced in attempting to use the "squirrel-cage" for splicing factory lengths of 2,000 ft., for holding dead-ends and for 90-deg. corners. Field experience established the fact that the squirrel-cage was not flexible in its uses, that it was too costly, that it required a costly workbench for field use and that it required too long an assembling time. In the initial method of installation the 2,000-ft. cable lengths were pulled in by a line gang and the splicing was done by an underground splicer. With this procedure the scheduling of work was

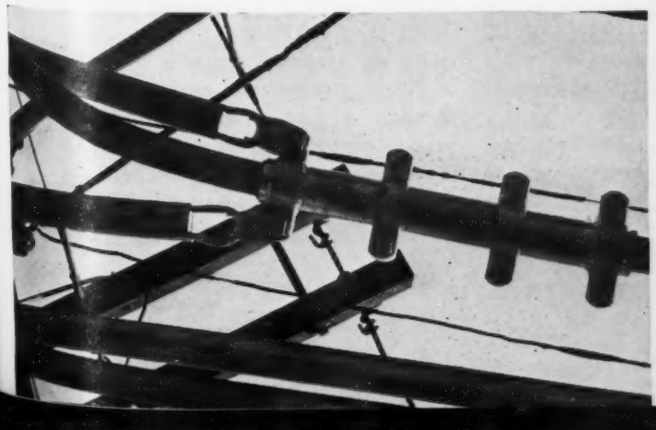


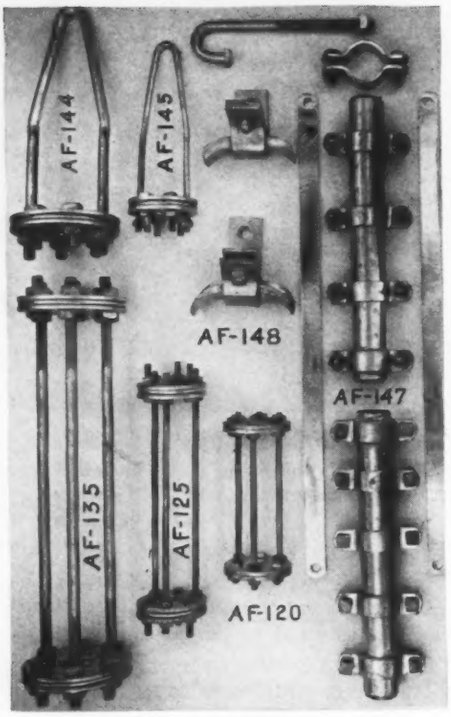
A RIGHT-ANGLE TURN in 4 x No. 2/0 S.S. (self-supporting) cable is held by Universal clamps attached to eye fastened in wall

UNIVERSAL CLAMP splicing assembly used to provide feed point for two-direction split. Feed is through cable at left into disconnecting boxes and then through splicing assembly into cable →



UNIVERSAL CLAMP holding a 4 x No. 2/0 cable feeding into a two-direction split at a terminal pole. The cable feeds into the upper left of the illustration at right





COLLECTION of hardware for use with self-supporting cable

AF-135—Original splicing and dead-ending "squirrel-cage" for 4 x No. 2/0 cable. AF-120, 125, 148 were for smaller cables. AF-148—New fabricated saddle for use as corner clevis saddle in conjunction with the bent bolt (above it) to allow saddle to swing away from pole. AF-147—Two Universal clamps with two 30-in. bars. Two symmetrical halves. Each half composed of covering steel plate (⅛ in. thick) curved at an inside radius equal to the cable plus ⅛ in. thickness of lead. At each end is welded a clamping and fastening strap. Raised punchings 0.05 in. high on inner side are pressed into lead liner to prevent slipping.

All hardware manufactured by Arch T. Flower, Wyndmoor, Pa.

difficult due to the time required by the splicer for connecting and making up his dead-ends or splices. This method also required the sagging of the cable to proper tension (approximately 2,500 lb.) prior to the installation of a tap-splice or final dead-end in order to determine the proper length, the squirrel-cage being installed on the ground with the cable slack.

New Splicing Clamp

After our initial field experience had been correlated and discussed, it was evident that we needed a "catch-off" clamp and a faster, simpler method of splicing. The author participated in the designing of the "Universal S.S. Cable Clamp," which is capable of meeting all conditions —in dead ending, in catching off, in making turns, as a working tool and in splicing (see various uses in the illustrations). The new clamp consists of two symmetrical halves, bolted together by fitted straps. The bolting pressure from the welded and the additional loose straps causes the lead liner to become rifled into the cable and grip it. When the sheath is opened the steel strands are bent back over the end of the clamp and reclamped by an additional strap. For splicing, the clamped ends are held together by two 30-in., ¼ x 1¼-in. galvanized steel bars between which the actual splice hangs.

Using the new Universal clamp, our installation technique was revised. The clamps are now installed by the gang, the cable pulled into place and sagged in at proper tension without delay, leaving sufficient end lengths of cable to do tapping or splicing. The splicers may then follow at any time and make the required splices. With this new technique the cable is sagged before it is spliced, eliminating any danger of conductor separation, but necessitating the making of the splice in the air. Effectively, we have created a manhole in the air.

Operating Experience

In a short period of four months' operation, our experience was benefited by a severe test the cable received following a heavy snowstorm. After hours of continued wet snowfall, a large tree with "snow-laden" leaves fell across the cable and aerial lines. Because of the electrical set-up of the aerial wire at the time of fault the circuit was tripped, but reenergized 34 minutes after the solid open-wire section had been cut clear. The cable carried load while on the ground under the fallen tree and while the line gangs installed new poles and returned it to its original position. Inspection of the cable, splices and terminal poles revealed as the only injury a sheared copper strand where the cable had been pulled out of the saddle on a fallen pole. The Universal clamps were used to sag and tie-off on both sides of the grounded four spans and proved to be an essential tool for this operation. Two line trucks with block rigging were used to pull the cable into the saddles. The cable returned to its proper position without showing any evidence of what had occurred other than the two newly installed poles.

Obscuring the possibility of electrical failures resulting from manufacturing or installation faults, the cable should have an expected life of more than 30 years. In order to obtain this, a routine painting schedule will have to be established after the first period of operation because of the action between the galvanized steel and tinned wires. This difficulty will be eliminated by the change to "copper-clad" steel conductor sheath.

Recondition Insulating Oil Economically

[*Continued from page 51*]

formers have been filled with reconditioned oil at their inspection periods. Because of the low cost of reconditioning and the quantity of the oil involved, chemical tests are not justified. Some oil may be replaced prematurely, but the net result is improved service to the customer and lower maintenance costs. Reconditioned oil is now used entirely throughout the Narragansett system.

Toward the end of 1935 a plant was designed to deliver 750 gal. of reconditioned oil daily. This plant was constructed and placed in operation in February, 1936. The process now in use consists of two treatments of each batch of oil, resulting in an output of 1,500 gal. in two eight-hour working days.

The first step consists of heating the used oil to about 150 deg. F. by circulating it through a heater. During the heating period an alkaline solution is added and the mixture circulated for one hour at 150 deg. F. The water and solids are then removed through the bottom drain in process tank No. 1 (diagram). Water is then sprayed on the surface of the oil until clean water appears at the drain. The oil is then decanted to a centrifuge, from which it is delivered to No. 2 process tank and circulated through a heater until the proper processing temperature (170 deg. F.) is obtained. A diatomaceous earth is then added and the mixture circulated

[*Continued on page 119*]

ECTRIFIED FARM sponsored by Pennsylvania Power employs 12,500 kw.-hr. per year at average rate of 1.68 cents and saves more than $90 per er through use of electric service

Usage and Demand Data Prove Economy of Farm Service

Pennsylvania Power Company-sponsored farm utilizes 12,500 kw.-hr. per year and the demand ranges from 4.8 kw. to 11.6 kw. — Customer's annual cash saving exceeds $90 per year

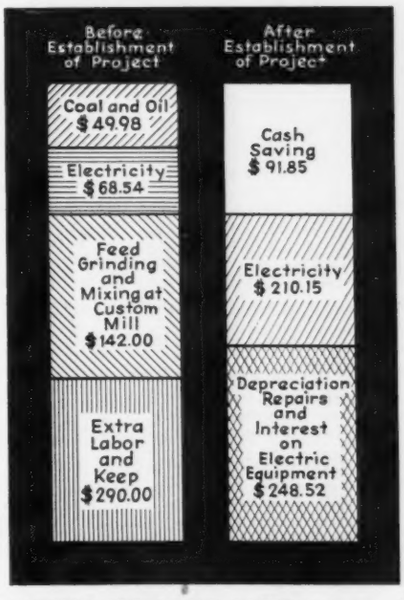
P. G. DINGLEDY, Pennsylvania Power Company, New Castle, Pa.*

IN 1939 the Pennsylvania Power Company, operating in five western Pennsylvania counties, sponsored two experimental farm projects with the co-operation of the Department of Agricultural Engineering at Pennsylvania State College and local chapters of the Future Farmers of America. The projects are located on the farms of R. N. Moose and sons, Lawrence County, and Mr. and Mrs. Free Waid, Mercer County.

The first year's operation of the projects has furnished considerable useful information, not only on the value of the electrical equipment to the farmer, but also on the load characteristics of the various applications in use.

In the case of the R. N. Moose farm, practically all of the electrical equipment was newly installed at the time the project was instituted, thus permitting a comparison of the cost of operation with and without the electric applications. Previous use of service was limited to normal household uses and barn and poultry lighting. New equipment included range, refrigerator, water heater, ironer, washer, water pump, milk cooler, feed grinder, feed mixer, brooders, water warmers and a 7½-hp. farm motor.

Making a liberal allowance for depreciation, maintenance and interest on the $1,701.60 investment in electrical equipment, the annual cash saving directly resulting from this equipment amounted to $91.85, as shown by the accompanying illustration. This included no estimates of such other probable savings as better preservation and preparation of food in the home, time and labor saving in ensilage cutting and hay chopping, healthier farm animals, greater cleanliness and other items difficult to evaluate. Nor was any attempt made to determine the benefits of greater leisure in the home and on the farm, or the opportunity for increased production through the utilization of that leisure.


Before Establishment of Project
After Establishment of Project
Coal and Oil $49.98
Electricity $68.54
Feed Grinding and Mixing at Custom Mill $142.00
Extra Labor and Keep $290.00
Cash Saving $91.85
Electricity $210.15
Depreciation Repairs and Interest on Electric Equipment $248.52

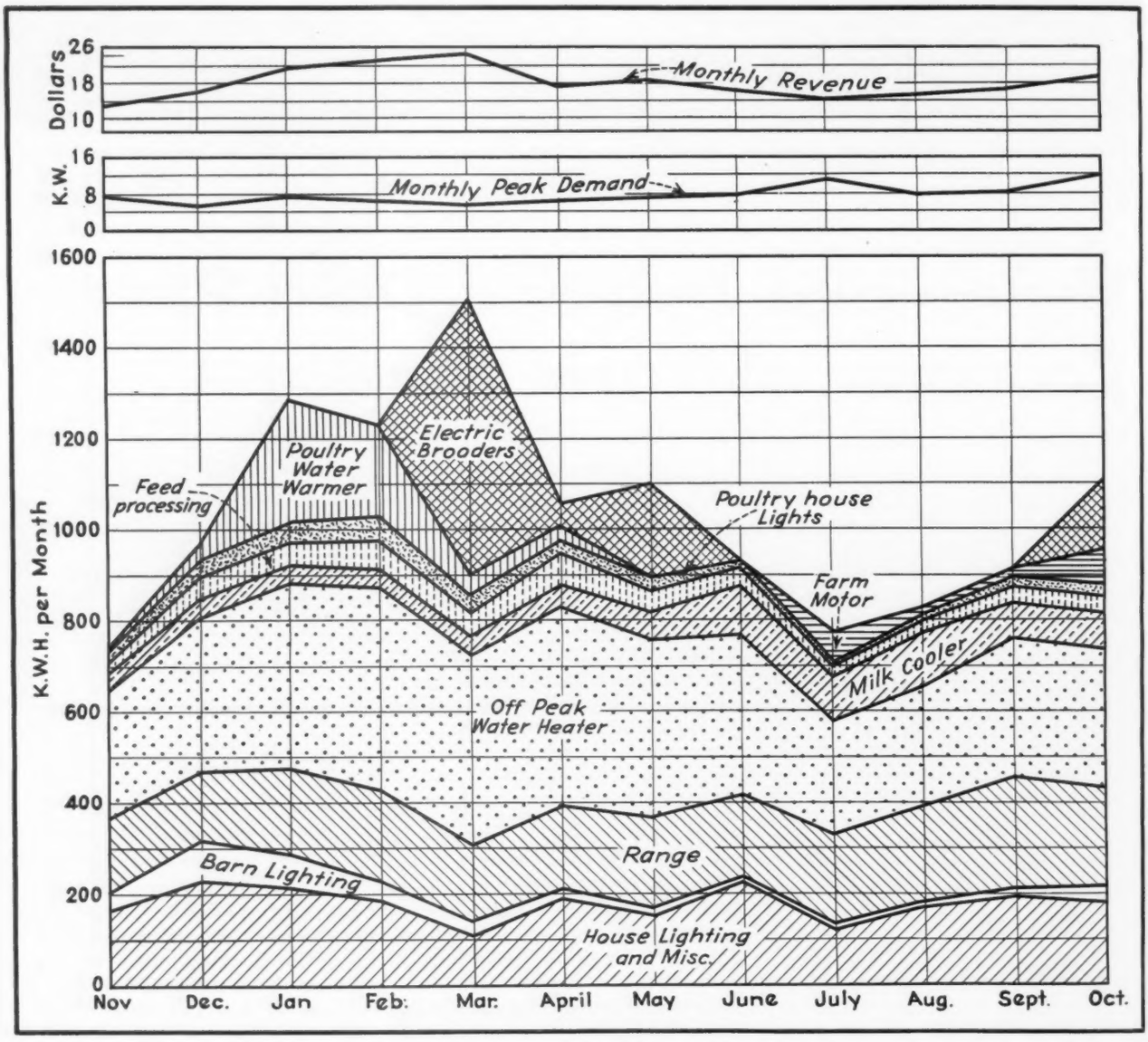
ANNUAL OPERATING COSTS before and after electrification. Farm operator saves $91.85 per year through use of electrical service. Revenue to utility is tripled, but other farm expenses are eliminated

Fully Metered

As a matter of fact, the investment in electrical equipment, together with remodeling expenses undertaken at the same time, precluded increases during the first year in the dairy herd or the poultry flock. With the beginning of the second year these benefits are being realized through such increases which are now under way. Thus, the cash saving of more than ninety dollars the first year is but a part of the present and potential benefits which the project has brought to the farm family.

Meters were installed on all of the

* Assistant to general manager.



COMPANY METERS were installed on individual appliances and from readings month-by-month usage is charted in construction of annual load curve

Operating Results, Twelve-Month Period, Pennsylvania Power Co. Rural Electrification Project

General	
Kw.-hr. used — general meter	8,375
Amount of bill	$165.27
Avg. rate per Kw.-hr	0.01961
Kw.-hr. used — off-peak water heater	4,188
Amount of bill	$44.88
Avg. rate per Kw.-hr	0.01071
Total bill	$210.15
Maximum 15-min. demand in Kw	11.6
Date of maximum demand, 9/25/40, a. m.	11:45
Electric Range	
Kilowatt-hours	2,281
Number of meals cooked	8,547
Number of bakings	126
Bread	623
Pies	228
Cakes	65
Cookies	5,500
Refrigerator	
Kilowatt-hours	369
Ironer	
Kilowatt-hours	135
Water Pump	
Kilowatt-hours	26
Gallons pumped used in house	25,006
Water Heater	
Kilowatt-hours	4,188
Gallons heated	14,457
Kw.-hr. per gallon	0.289
Barn Lights	
Kilowatt-hours	378
Milk Cooler	
Kilowatt-hours	777
Number gallons cooled	12,543
Kw.-hr. per gallon	0.0619
Bacteria, per c.c. or less in all tests	3,000
Feed Grinder	
Kilowatt-hours	463
Pounds of ear corn	21,380
Pounds of shelled corn	18,300
Pounds of oats	17,975
Total pounds ground	57,855
Total grinding time	hours 136, minutes 42
Kw.-hr. per 100 lb	0.8002
Feed Mixer	
Kilowatt-hours	53
Pounds mixed	102,885
Mixing time	hours 42, minutes 10
Corn Sheller	
Kilowatt-hours	9.5
Number of bushels	946
Farm Motor	
Kilowatt-hours	177
Tons of chopped hay	35
Loads of chopped straw	12
Tons of corn ensilage	50
Total time	hours 25, minutes 22
Lights Unmetered	
Kilowatt-hours	1,606
Electric Brooders	
Kilowatt-hours	1,016
Number of chicks	1,548
Kw.-hr. per chick	0.656
Poultry House Lights	
Kilowatt-hours	324
Number of hens	9,880
Kw.-hr. per hen	0.0327
Hours used per day	hours 2, minutes 50
Number of eggs produced	145,688
Water Warmers	
Kilowatt-hours	594
Kw.-hr. per hen	0.0601
Hours used	1,485

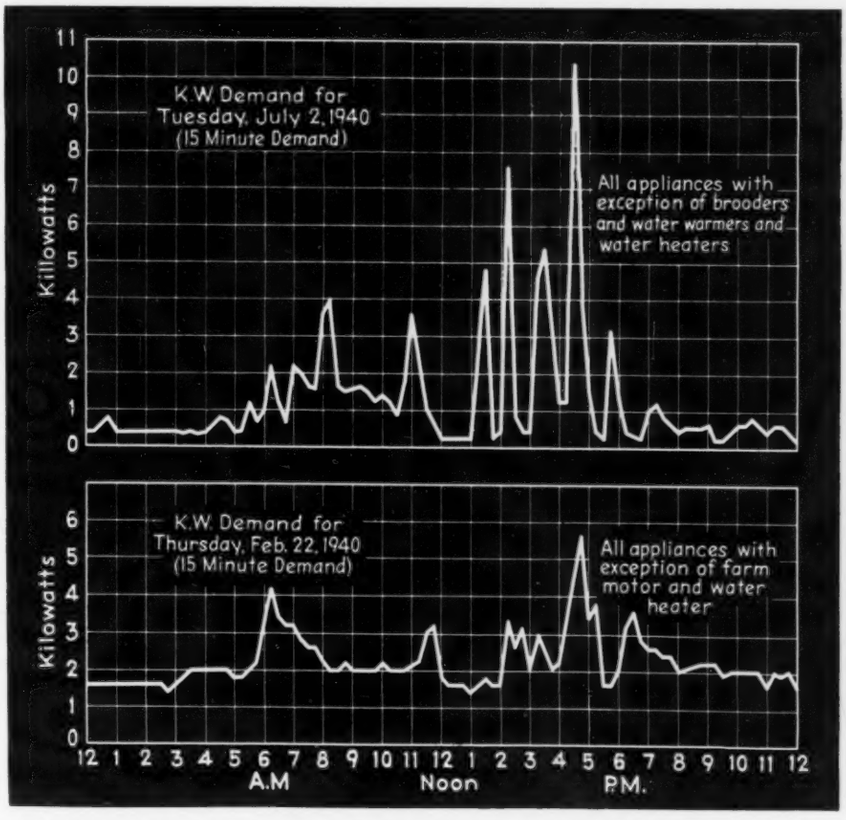
new equipment installed at the farm and an accurate record kept of the kilowatt-hour use. Data were also collected on the production of each appliance, including such items as amount of baked goods prepared, water pumped and heated, milk cooled, feed ground and mixed, etc. (see table). Thus, accurate information was made available for the use of the utility and appliance dealers in their sales efforts. Data thus secured have been used freely in direct mail and personal sales contacts.

A fifteen-minute demand meter was installed at the service entrance, totalizing all demands with the exception of the off-peak water heater. This has yielded useful information to the company as to the effect of the various appliances on the loading of the transformer and distribution circuit.

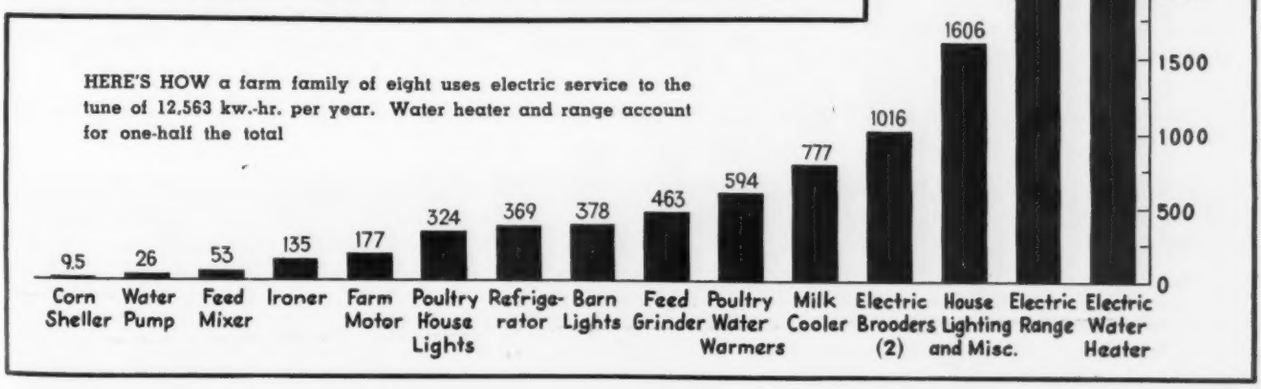
Typical winter and summer daily load curves are shown in an accompanying illustration and the monthly fifteen-minute peak demand is shown above the preceding chart of kilowatt-hour use. The winter curve is quite obviously affected by the use of brooders and water warmers, resulting in a fairly steady demand throughout the day and night. The summer curve was taken on a day when the farm motor was being used to chop hay. An exceptionally high peak was established as a result. Actually the lowest monthly peak, 4.8 kw., was recorded in the month of March with the highest kilowatt-hour use, while one of the highest peaks, 10.4 kw., occurred during the hay chopping season in July, when, in spite of the motor, the kilowatt-hour was lowest. While this established the farm motor as the poorest application from a load factor standpoint, it indicated the need for greater promotion of summer-use appliances.

Summer Loads

As one possible solution to this, insect control was tested during the summer. A home-made insect trap, consisting merely of a 50-watt lamp hung over a pan filled with water, with a thin film of waste oil on it, was installed in the middle of the vegetable garden. This was kept lighted all night during the summer season and it effectively eliminated insects without dusting or spraying. The cost of current almost exactly balanced the cost of insecticides, but the electric method reduced labor considerably, since the only labor involved by it was the occasional cleaning of the tray, as against the time required for adequate dusting and spraying. [*Continued on page 116*]


K.W. Demand for Tuesday, July 2, 1940 (15 Minute Demand)
All appliances with exception of brooders and water warmers and water heaters
Kilowatts
K.W. Demand for Thursday, Feb. 22, 1940 (15 Minute Demand)
All appliances with exception of farm motor and water heater
Kilowatts
12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12
A.M
Noon
P.M.

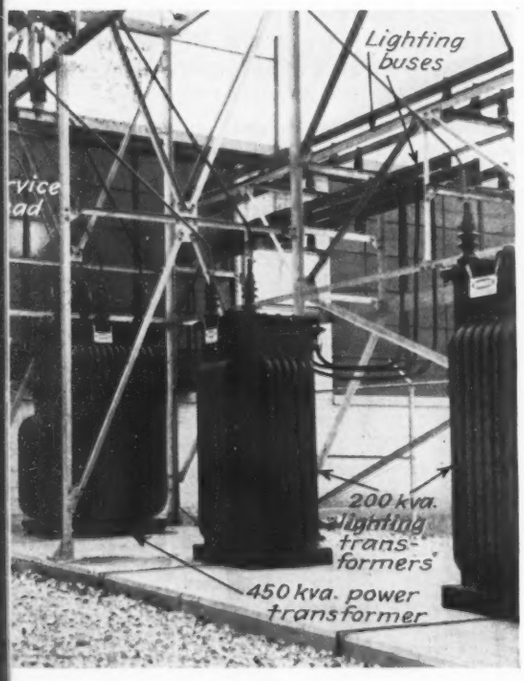
TYPICAL load curves for summer and winter, based upon fifteen-minute demands. Experiments are under way to build up usage in summer time and improve load factor



NEW, LOW, monitor-roof building of Square D Company in Milwaukee

Distribution Goes Underground in New Factory

Under-the-floor feeders in fibre conduit supply accessible overhead metal-clad subfeeders through breaker type distribution panels in new Milwaukee factory — Non-continuity of conduit ground a problem



TWO 200-kva. lighting transformers—tapping different phases—and a 450-kva., three-phase power transformer serve plant requirements. Cables from the two secondary lighting buses and power transformer enter plant through weatherproof service head which incloses slotted micarta plate in shop window frame

BORROWING a leaf from utility distribution design, the Square D Company has evolved a notably flexible combination underground and overhead system for lighting and power supply in its new one-story factory building at Milwaukee. While keeping main feeders out of production's way in 3-in. fibre conduit in underfloor concrete ducts, the arrangement provides nearly infinite accessibility to power sub-feeders which are in overhead metal-wireway. The transition from underground main feeders to overhead sub-feeders is through strategically located metal-inclosed breaker type distribution panels.

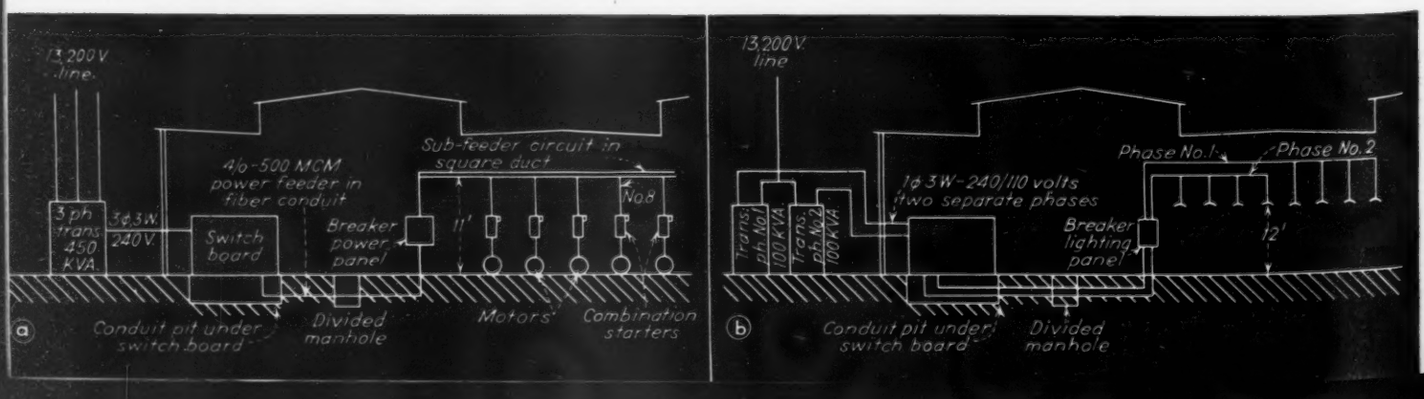
Consideration, in early stages of the design, was given to a three-phase, four-wire system for both lighting and power supply in this 238x430-ft. plant. But problem of flicker and regulation with even a moderate spot welding load caused this system to be discarded in favor of separate power and lighting circuits. A three-phase, 240-volt, three-wire power system is used, with one phase grounded in accordance with Wisconsin Code requirements. Lighting is taken from two separate three-wire, single-phase circuits, to avoid loading one phase too heavily.

Grounding Problem

Use of non-metallic conduit for the underground main power feeders throughout the plant imposed a problem of maintaining the necessary continuous conduit grounding system and necessitated a special conduit grounding arrangement. The Wisconsin Code requires that interior conduit, cable armor, raceway, etc., be metallically connected to form a continuous electrical conductor and that it be grounded whether or not it incloses grounded system conductors. It is also required that the system grounding connection for interior wiring be at one point only; *i.e.*, switchboard or service entrance.

With the non-metallic conduit breaking the continuity of the conduit grounding system between the switchboard and the junction boxes, how were junction boxes and metal sub-feeder wireway to be grounded?

POWER (a) and lighting (b) supply system for new Milwaukee plant combines runs of feeder circuits underground and sub-feeders overhead in accessible metal wireway



COMBINATION starters for tilting-bed presses are grouped because machines lack convenient mounting facilities

Sub-feeders 4x4 in. metal inclosed wireway
Grouped starters
Breaker-type power distributor panel
Main feeder riser
Dist. panel bonded to building steel

UNDERGROUND FEEDERS terminate at nine strategically located power panels (10 more for lighting). Radiating from these at a uniform height are 4x4-in. metal wireway sub-feeders with No. 2 copper conductors

Solution lay in a special ruling of the Wisconsin Industrial Commission which permitted the distribution panels to be grounded to the building steel, which is bonded to the water sprinkler system. Main system grounded at the switchboard is connected through a No. 3/0 conductor in 1-in. conduit to a central sprinkler riser. Four sprinkler risers are bonded to adjacent building steel. Had it not been for this special ruling it might have been necessary to run a common ground bus through each power feeder conduit in order to connect each power distribution panel to the system ground.

Feeder Systems

Separate buses from the 450-kva., three-phase, 13,200/240-volt power transformer and the two 220-kva., single-phase, 13,200 to 240/110-volt lighting transformers enter the building about midway of its length and pass to the main metal-inclosed, dead-front switchboard, to be broken up into circuits. A 1,600-amp. I-T-E air circuit breaker is provided for the three-phase service and two 800-amp., two-pole breakers for the incoming single-phase lines.

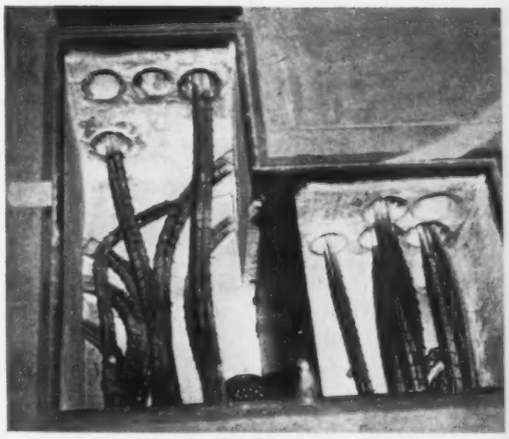
From the switchboard power and lighting feeders drop to a pit, divided into two parts to isolate the two systems, and pass to four divided "manholes" in the factory floor which extend in a line across the plant parallel to the columns. The power and lighting feeders radiate from these manholes to various parts of the plant, terminating at the ten lighting and nine power distribution panels.

Power feeders range in size from No. 3/0 to 500,000-circ.-mil, with, in general, one feeder to each distribution panel. Feeders are designed for 1.5 volts drop. It is interesting to note that use of a three-phase, three-wire system (one phase grounded) for power permitted the use of two-pole breakers throughout the plant, with considerable saving over the three-pole breakers that would otherwise have been needed for the power system. Breakers at the power distribution centers range in size from 40 to 100 amp.

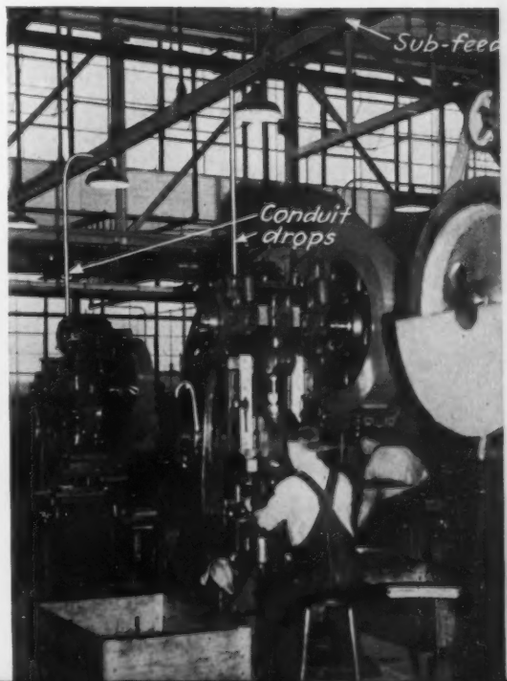
From the power panels runs of 4x4-in. "Square Duct" containing No. 2 conductors were extended radially over the production machines. In all cases the square duct was mounted 12 ft. from the floor, so that when location of production machines is changed conduit extending from the machine control to the duct would be of the proper length to reach the overhead sub-feeder at any point in the plant. Conduit drops from the sub-feeder wireway to machines are by the nature of the system limited to well under 25 ft.

A total of 265 kva. of spot welders in six units are in use in the Square D plant. These are isolated in one part of the floor and all served from one panel. All these welders are connected from the grounded phase of the power system to one or the other of the underground phases, so that the load is balanced and no single

[*Continued on page* 119]



FOUR divided manholes 48x48x24 in. in factory flo at points from which main feeder cables in 3-I fibre conduit radiate to strategically located break type distribution panels. Feeder cables range in si from No. 4/0 to 500,000-circ.mil and designed f 1.5-volt drop



DRIVEN MACHINES such as punch presses, drill presses and electric welders connect to subfeeders through short conduit drops. For convenience in shifting machines height of wireway is the same throughout plant

Editorials

S. B. WILLIAMS, *Editor*

Responsibility for Adequate Power Supply

HOW MUCH of the responsibility for supplying power to serve the increasing industrial demand rests on electric utilities and how much upon industry itself? The 1939 Census of Manufactures power report, just released, shows that in the year prior to our National Defense effort industry was supplying 40 per cent of its own electrical energy needs and buying the other 60 per cent from utilities.

This element of responsibility never appears in the releases of the Federal Power Commission regarding impending power shortages. It is time that somebody should point this out if the utilities are not to be blamed for something which is not entirely their responsibility.

In one of the Middle Western areas manufacturers of electric steel are reporting difficulties getting sufficient power for electric steel furnaces. The first thing one concludes is that a power shortage is developing. Upon further investigation it appears that part of the problem at least is something different. The shortage that is developing is power at an extremely low price. Is it the responsibility of the power people to furnish firm power to these temporary loads at give-away prices? The steel manufacturer will get back his added investment costs in a very short time, but a utility serving this load may never get its costs back.

Prior to the depression electric steel furnaces took a large block of power, but, according to a study by Batelle Memorial Institute, when demand for steel fell off electric steel making became less popular because of the demand rates. In other words, the steel people are willing to take power for their electric furnaces when there is a demand for the better steel, but are not willing to take the demand responsibility during dull periods. They want firm power at dump power concessions.

And this is only one instance. General industry takes its responsibility for adequate power supply very lightly. In 1939 manufacturers supplying their own power had less than a 10 per cent generating reserve. Last year, when the utilities had in excess of a 30 per cent reserve, they were cautioned against a 1942 shortage. What this means, of course, is that outside of those industries where the heat balance makes it undesirable to purchase power the central stations are being called upon to supply virtually the entire added defense load in spite of the fact that it is temporary and everybody knows it.

There is nothing to indicate that the utilities cannot handle this load as it arises except where injudicious planning by industry or by the Army and Navy has concentrated large power contracts. On the other hand, if the utilities are to be expected to assume a responsibility far beyond their normal ratio they should not be expected to submit to rate-chiseling practices.

Pharaoh found centuries ago that one cannot make bricks without straw.

Reasons for 120-Volt Secondary for 1½-kva. Rural Transformer

WHEN the joint E.E.I.-N.E.M.A. committee produced a new standard design of distribution transformer there was some doubt whether there was full justification for holding the 1½-kva. unit alone to a 120-volt, two-wire pattern, all the others three-wire. These smallest units are hardly used anywhere except to serve rural customers, and especially those with loads not going much beyond lighting, radio, refrigerator and perhaps a hot plate or roaster, all 120-volt devices. They have been and are still being bought in substantial numbers.

One of the more important reasons for not providing three-wire secondaries is the disadvantageous unbalance of farmhouse load and consequent unbalance of the two voltages to neutral wherever one of these large-ampere devices comes on either side of a relatively small-ampere transformer. In fact, a concentration of full load on one side or half the winding raises the voltage regulation more than 50 per cent above its 240-volt value. Many tests of typical 4.8-kv., three-wire units in actual service show substantially more spread of voltage than for two-wire units of the same 1½-kva. rating.

This factor has added significance when one takes note of the trend in appliance wattages. They have been going steadily upward and present representative values run about 1,000-1,200 watts for irons, 1,350 watts for hot plates and 1,350-1,500 for roasters.

Another point not to be ignored is the fact that the user not infrequently acquires heavy-duty appliances without the knowledge of the co-operative or the utility. A burned-out transformer is pretty sure to result from switching a 240-volt range onto a 240-volt, three-wire, 1½-kva. transformer, whereas a two-wire unit would be more likely to survive the ordeal than would the customer's temper.

Add to this the substantial reduction afforded in the

price of the two-wire rural individual-customer transformer and there seems little warrant for not conforming to the committee's decision.

The Time to Run and the Time to Stand

THE FIRST FATALITY in the battle of SEC with associations is reported and it is rumored that others will soon be but a memory. Since these actions have been taken without SEC having rendered any formal opinion of the effect of association registration upon intrastate members, one wonders if perhaps in some instances registration did not offer a welcome opportunity to save in association dues.

There is no question but what utilities more and more have to economize, but at what cost? If an association is not profitable to its members it should be dissolved. But when an association, such as some that are now in jeopardy, can show savings to member companies that are many times the amount of dues it seems like bunghole economy to let it fold up.

Right now the Edison Electric Institute is reducing its force because of the necessity for reducing expenses as the result of recent resignations. Some of those who will be let go will be people of long training in association activity. Their loss to the Institute's effectiveness will be much greater than the dollar saving.

While discretion is sometimes the better part of valor, there are also times when courage is necessary. Our recollection is that as kids whenever we ran away from a cop he always chased us to find out what deviltry we had been up to. Although SEC people have given several off-the-record opinions, none of which see any occasion for this alarm, no formal opinion has been released. Until such a formal statement is made perhaps it might not be a bad idea for a fellow to keep his shirt on.

Foot-Candles Will Dispel Fluorescent Wattage Worries

EARLIER in the year we called fluorescent lighting the quarter-billion dollar baby and prophesied that before long it would be in the billion dollar class. Some of our friends in the lighting business thought that we were somewhat extravagant with our figures, but at the rate the business is now going it appears htat, if anything, we might have been too conservative.

So far fluorescent has to a considerable degree grown from customer demand. Ordinarily in such a market those in the business are satisfied to let the customers set the sales pace until they begin to slow down. With fluorescent, however, it is not possible to let the customer continue to set the pace.

Fluorescent lighting is the most efficient commercial light source yet developed and the customer knows it. That is the reason for a large part of this interest. What he hasn't yet appreciated is that it is the only available light source that will give him real high intensity general illumination comfortably. This must be sold to him.

So long as efficiency rules the customer's action, replaced lighting wattages will be smaller. And if that was all fluorescent had to offer, the utility industry would have to accept the situation and make the best of it. Fortunately, however, it isn't all and utility salespeople are beginning to see in this new light source an opportunity rather than a liability.

The opportunity lies in selling foot-candles—not the measly little 10- and 15-foot-candle jobs of the past, but 40, 60 and 100 foot-candles. With this kind of selling wattage nightmares will cease.

This is the job that the utilities will undertake and when they get rolling the speed with which fluorescent grows up into billion dollar manhood will be limited only by the ability of the manufacturers to produce.

Construction Crew Training for Live-Line Maintenance

INSURING continuity of service becomes even more essential when power demands tax the reliability of existing facilities. The trend, therefore, is to focus strongly on preventive and corrective maintenance, which includes live-line maintenance.

So acceptable has live-line maintenance become that a large percentage, if not all, of the 6,000-odd new miles of 1941 transmission will undoubtedly be designed with live-line maintenance in mind. Experience has shown that efficacy and safety in following this practice are both advanced if adequate provision is made not only in the line design but also in picking and training the crews.

Thus it is well to allow ample clearance between live parts and hardware. For instance, on dead-end strings it is a simple matter to provide a short link between the insulator string and the tower plate so that the linemen will have more working space behind the insulators in which to work their equipment. As voltages increase, larger and heavier equipment is required and more space is needed therefor. Similar consideration to other details of line construction with a view toward working space would assist in making "hot" work easier.

It is also advantageous to avoid, as much as possible, the tying of conductors around insulators or clamps in such a manner as to make it virtually impossible to extract them with "hot sticks." If a piece of pole line equipment is susceptible to damage and may need replacing at some future date, it is well to bear this in mind during installation and to use the type of construction that will best adapt itself to "hot-stick" work.

Furthermore, it should be remembered that standardization of structural arrangement will permit a standardization on tools for the entire system.

Gander Sauce

By CARTER FIELD

This noted journalist gives his personal comments and interpretations on current happenings affecting the electrical industry. His background and his location at Washington make his thoughts informative and interesting even though all may not agree with him

ANYTHING too big is bad.

For some fifty years that has been an axiom among the left wingers. It was first made popular among the liberals and pinks of the day just after the turn of the century by Louis D. Brandeis, patron saint of the Woodrow Wilson reformers and of the New Deal through the first FDR administration.

How big is "too big"? It has never been clearly defined, but with Brandeis, and he was always a master at clear expression, it was not *just* bigness in the anti-trust sense—bigness which by its size was able to throttle competition. The evil primarily lay in size itself. If a thing was expanded enough, weakness developed. Administration lost the close-up scrutiny of details, lost its sensitiveness to customer and public reactions. In a corporation it was bad for the customers, bad for the public, bad for the employees—bad even for stockholders. It took on the vice of absentee landlordism. It became impersonal. Irate customers could talk only to underlings powerless to change policy or correct wrongs. Bookkeeping magnified expense and replaced intelligence.

He Changed His Mind

When Franklin Roosevelt came to Washington, in 1933, as the newly elected President, he was by way of being a fan on this Brandeis antagonism to bigness. He even applied it to government buildings. He thought the Commerce Building, then new, absurd—joked about it to friends—Hoover had built it, for Hoover. Since then Roosevelt has approved an even larger building—for the Department of Agriculture. He seems to have also parted company with the whole theory, or rather to have modified it. As it now stands in the Administration lexicon: "Bigness is bad—unless *we* run it."

This opposition to bigness was one of the keys to the public utilities holding company act, particularly the death sentence feature. The fundamental theory here was that bigness was bad in the electric industry. Systems must be "integrated." The territory in which they operated must be contiguous. Control of a company in the Southwest by a company more interested in New England, for instance, was bad.

But in its recent pronouncement with regard to the Commonwealth & Southern the SEC goes further in the old Brandeis direction. Size itself is an objection. For instance, the electric systems of Alabama and Georgia, though these states adjoin, are too big to be left in the hands of one company. They must be divorced. This, of course, is a very different notion from that which required that the Commonwealth & Southern could not retain both its Michigan and its Southern companies.

But suppose we assume that the Brandeis theory about bigness is absolutely sound—that no advantages which size could possibly produce could outweigh the objections?

How about bigness in government operation in the same field?

TVA is, or certainly will be, considerably larger than the Alabama and Georgia companies of Commonwealth & Southern put together. The Columbia River development threatens to become fairly obnoxious if size is evil. The Arkansas River setup will stretch from Colorado to Louisiana.

Super-Super-Size

But that's only part of the picture. The present intention of the Administration is to have all of these government electric developments head up through a series of underlings to a single bureau in Washington—a bureau that will be subordinate to the Secretary of the Interior!

No announcement has been made that TVA is to be put under "Honest Harold" Ickes, as yet, but the President has told congressmen that he wants the Arkansas development to head up through Interior, and the bill for the Columbia system is being engineered with the same objective.

So—if FDR and Ickes get their way—which there is no reasonable expectation to doubt, despite a lot of resentment out in the sticks—we will wind up with a mammoth electric administration bigger than any two or three of the holding companies, the size of which was so objectionable, combined.

Lilienthal, of TVA, sees the handwriting on the wall. He knows it is only a question of time when Ickes' greed for power will threaten the present autonomy of TVA. So he is opposing it. The folks out in the Northwest, as told in a recent article in this space, are opposing it. *But no soulless and "public be damned" corporation was ever so unresponsive to the complaints of individuals as a benevolent dictatorship eager to do, not what its people want, but what it considers best for them!*

No Chance for Redress

Which brings up another point on which we have never heard from Justice Brandeis. When a privately owned corporation gets so swollen and intolerant that its enraged customers have no success in getting attention for their complaints there is always one remedy. Folks can always start a movement aimed at getting government to curb the offending corporation.

It can be a movement, mark you, with no political connection, not complicated by any other issue. We have seen lots of them in this country. But when the customers are sore with an electric empire run by remote control from Washington, what is the chance of redress?

Have you noticed how much attention Mr. Ickes has paid to the wishes of the people of San Francisco in that matter of Hech Hetchy power? Yet San Francisco is one of the great cities of the country. A small town or county would be crushed by some subordinate without Mr. Ickes even hearing about it.

Can it be that the old adage, "what is sauce for the goose is sauce for the gander" is going to have a New Deal Thanksgiving operation?

NEWS OF THE WEEK

SEC Orders U.G.I. Sell Nine Units in System

Disintegration ruling seen as signpost for other utility holding company systems — All holdings outside of area around Philadelphia must be divested — Healy delivers decision

Application of the "disintegration" provisions of the holding company act moved into new ground this week with SEC's formal order directing the United Gas Improvement system to divest itself of all holdings in utility properties outside the tri-state area around Philadelphia. U.G.I. holdings in nine utilities are affected.

Reaching beyond the scope of the order's application to the U.G.I. system, however, were several points decided by SEC which provide signposts for other systems. One of these points was assertion by SEC of its authority and "duty" to enter piecemeal orders in Section 11(b)(1) cases as soon as the hearing record is complete for a particular phase of a case. Thus, U.G.I. is ordered to dispose of nine properties admittedly not part of its principal system or retainable as additional systems before final determination is reached as to the scope of the major system.

SEC also ruled formally that its authority under the act covers not only "other businesses" of holding companies but all their investments, either utility or non-utility. As to these operations SEC ruled it did not have the burden of finding such operations unnecessary; rather, that holding companies must affirmatively show that they meet the standards of Section 11 if they wish to retain them.

SEC also attached to the U.G.I. order an appendix restatement of its conclusion in the Columbia Gas & Electric case that electric and gas companies cannot be combined into one system. Standards set out for an electric system differ from those for a gas system, SEC says, and there is no indication of any over-all standards which might be applied to a combination of both.

The opinion definitely found New Haven Gas Light Co. and Connecticut Railway & Lighting Co. are U.G.I. subsidiaries, along with Hartford Gas Co., and listed all three for the "chopping block," denying U.G.I.'s contention that Connecticut law prohibiting "outside" control of state utilities prevails in conflict with the federal act's definition of utility subsidiary.

Other companies ordered sold are Arizona Power Corp., Wyandotte County Gas Co., Bridgeport Gas Light Co., Concord Gas Co., Manchester Gas Co., and Nashville Gas & Heating Co.

Commissioner Robert E. Healy read the U.G.I. opinion from the bench at the start of a hearing at which U.G.I. was to have replied to a show cause order for disposal of its ice properties and its holdings in Public Service Corp. of New Jersey. This was postponed until May 6.

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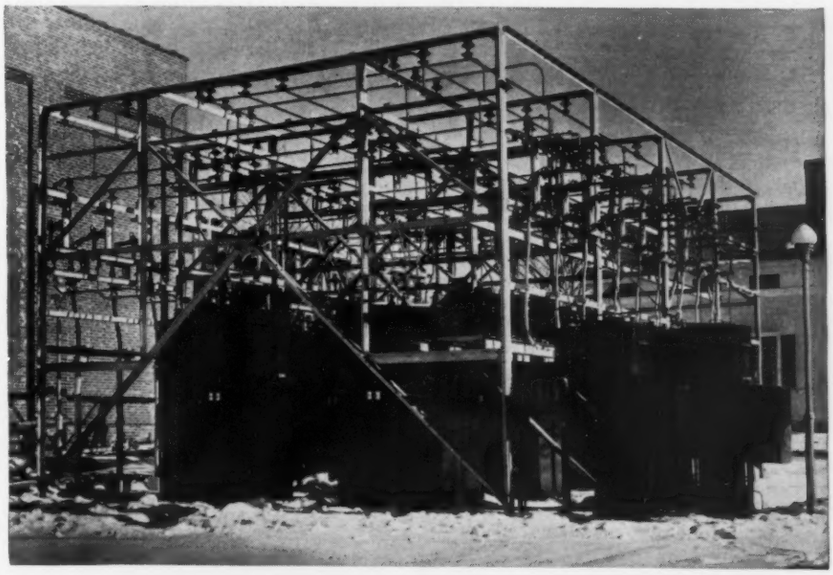
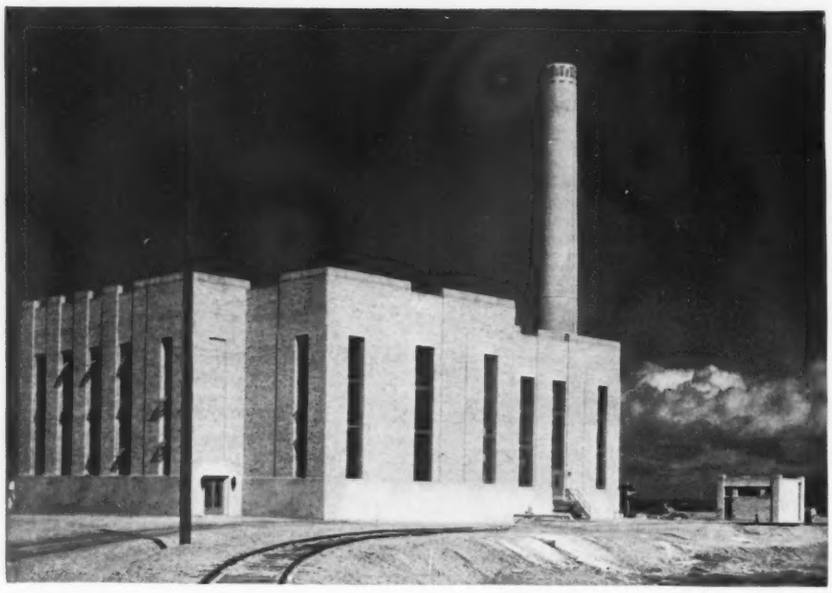
U.G.I. Sells Holdings in Connecticut Utility

Last week United Gas Improvement Co. divested itself of its investment in Connecticut Light & Power Co. by the sale of 701,253 shares of no-par value



NEW OUTDOOR FACILITIES—Fall River (Mass.) Electric Light Co., a New England Power Association subsidiary, improves its local 4-kv. substation facilities at Hathaway Street with outdoor installation of buses, feeder reactors, regulators, switch and metering cabinets



NUECES BAY POWER STATION—Central Power & Light Co. placed in operation 15,000 kw. of capacity in this new station at Corpus Christi, Texas, which is now furnishing power to the many Army, Navy and aviation stations in the territory

common stock to a nation-wide underwriting syndicate headed by Drexel & Co. Public offering was made of the stock at $42.50 a share and this week the syndicate reported that practically all shares had been sold to investors in thirty states and the District of Columbia.

U.G.I. sold its holdings of about 61 per cent of the outstanding stock in the Connecticut utility to comply with the integration provisions of the utility act. The average cost of the stock to U.G.I. was $39.84 and the underwriters paid the company $39.50 for the stock. The company had asked $40 a share.

Practically all of the stock was sold in small lots, with one dealer reporting that 2,400 shares were distributed to 98 accounts. There was only a moderate demand from institutions and no very large blocks sold. New York distributors took the largest percentage of the offering, 41.3 per cent of the total, but some of this went to branch offices of New York firms in other states. Distribution in other states included 18 per cent in Connecticut, 2.9 per cent in California, 3.9 per cent in Illinois, 1.4 per cent in Wisconsin, 9 per cent in Pennsylvania, 1.5 per cent in Rhode Island, 2.4 per cent in Maryland, 9.9 per cent in Massachusetts, 1.8 per cent in Missouri, 2 per cent in Ohio and less than 1 per cent in Colorado, Delaware, Washington, D. C., Florida, Georgia, Indiana, Kentucky, Louisiana, Washington, Virginia, Texas, Tennessee, Maine, Michigan, Minnesota, Nebraska, New Hampshire, New Jersey and North Carolina.

Texas Utility Extends Lines to Army Camps

Central Power & Light Co., Corpus Christi, Texas, has gone to great lengths to insure adequate and dependable power to forts, military training camps, naval air training stations, army air fields, shipbuilding yards and defense industries. The company is spending $2,855,400 this year on expansion and improvement of facilities, according to President Lon C. Hill.

The company is now serving the following forts and military training camps: Fort D. A. Russell, Marfa; Fort Clark, Brackettville; Fort McIntosh, Laredo; Fort Ringgold, Rio Grande, and Camp Hulen, Palacios.

The Corpus Christi Naval air training station was started in June, 1940, and is to be completed this summer. The project includes three auxiliary fields and the estimated power requirements are 3,500 kw. Service is also being provided to the 400 units of Naval Housing Authority, Corpus Christi, as well as the 400 housing units for civil employees and 100 housing units for enlisted men.

An Army air field is proposed at Victoria to be constructed this year and it will have an estimated load of 500 kw. The Army air field proposed at Harlingen to be constructed this year will have an estimated load of 400 kw.

Mr. Hill stated that present and proposed power requirements will be served from the company's integrated power system and the expansion of the Nueces Bay power station.

NEWS BRIEFS

A PROPOSAL for an independent Columbia River Authority to market Grand Coulee and Bonneville power has been sent to congressional delegations of Washington and Oregon by the Northwest Public Power Association, formed by seventeen municipal power and light systems and PUDs operating in the two states. The agency would be similar to TVA, but would be outside of control of Secretary Ickes.

ANOTHER DEFEAT of public utility ownership was administered by Detroit voters last week when three proposals sponsored by the City Council to empower the city to acquire and operate some of the Detroit properties of Michigan Consolidated Gas Co., American Light & Traction subsidiary, were turned down by majorities varying from two to one to three to one. The campaign was a hot one while it lasted.

FIRST IT WAS wind-power plants, now it's the radiant-energy heat. Knowing a good thing when they see it, the Soviets are utilizing this method for making hay and drying grain. The Dniepropetrovsk branch of the Soviet Institute for the Electrification and Mechanization of Agriculture makes use of nichrome wire spirally wound on porcelain cylinders and heated electrically to 600 to 700 deg. C. Drying rooms in which these cylinders are installed can be built on any farm.

HEAVY DEMAND for aluminum has delayed construction of a 132,000-volt line by Ohio Power Co. from Crooksville to Lancaster. The 32-mile line would stabilize service for local industries and add capacity for expansion.

INSURANCE PREMIUMS FOR DEPENDENTS of all employees drafted into military service will be paid by Arkansas-Missouri Power Corp., President James Hill, Jr., has announced. All employees completing their military service will be restored to their former positions, if re-employment is desired.

WORKERS IN SEVERAL General Electric departments canceled their 1940 vacations for equivalent bonuses in pay in order to expedite equipment for the new *U.S.S. North Carolina*, new battleship recently commissioned three months ahead of schedule.

HARTFORD ELECTRIC LIGHT'S 27-kv. gas-filled cable between South Meadow station and Laurel Street substation is now in service and is believed to be one of the longest installations of the kind thus far completed.

Urge Rationing to Meet Shortage of Engineers

Dr. Davis proposes program to Midwest Power Conference to meet situation in defense industries — Scattered unit generating plants seen as future possibility — Power problems discussed

An "appalling" shortage of young engineers, to fill the rapidly increasing number of engineering jobs in defense industries, last week led Dr. Harvey N. Davis, president of Stevens Institute of Technology, in speaking before the Midwest Power Conference in Chicago, to propose two courses of action to meet the situation: (1) Short intensive training courses for high school graduates and arts college men to produce acceptable engineering apprentices, and (2) conservation of the meager pool of engineering trained men by establishing a system of priorities in men as well as raw materials.

Speaking at the "all-engineers" dinner conference, Dr. Davis declared that "production for the present is far more important in the national defense picture than combat training. "At least for the present, no engineering-trained men, no matter how young or inexperienced, should be drafted from industry," he asserted.

Unit Power Plants

A. G. Christie, Johns Hopkins University, in reviewing power trends, indicated that scattered steam-generating stations of moderate size are a future possibility. Conspicuous geographical locations of hydro-electric plants make them vulnerable from a military viewpoint and emphasize the need for steam standby plants. Unit (one-boiler, one-turbine) plant construction is permitting small plants with efficiences equal to super-power plants.

Alfred Iddles, Babcock & Wilcox, warned boiler users that operation of 1,250-lb., 900-deg. steam stations is no "child's play." Mr. Iddles urged operators to give close attention to steam temperature regulation, not only as to magnitude but also as to rate of change of steam temperature. It is impossible to maintain strictly constant steam temperature conditions in the 900 to 1,000 deg. range and at the same time permit the wide swings in steam output that some systems require. Operators should either select more moderate temperatures, where swinging loads must be carried, or choose less sensitive machines.

C. C. Franck, Westinghouse, stated that metallurgical problems hold the center of importance in modern steam turbine design. Bolting has been a major problem, he stated. Although high temperature bolting is performing satisfactorily, it is under careful scrutiny. High temperature bolting should not be subjected to heavy wrenching, but bolts should be accurately set up by use of heating elements and light wrenching.

Without factory-assembled substations this country would be faced with a bottleneck of serious proportions due to the lack of experienced substation designers, W. J. McLachlan, General Electric, told delegates.

Limitations placed on power transmission by system stability was the subject of a paper by H. E. Wulfing, Commonwealth Edison Co., at the electric power transmission session.

Discussing utility interchange contracts, John T. Davis, Indianapolis Power & Light Co., reported that his company derives a revenue of $808,605 annually by selling both high-pressure steam and electricity to eleven large industrial plants in Indianapolis, four of which generate a part of their electrical requirements.

G. V. Edmondson, American Blower Corp., said advent of larger power plant auxiliaries had increased interest in adjustable speed drives with promise of increased economies to keep pace with forward strides in efficiencies of plant primary equipment.

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Asks Removal Action

Mayor Jap Bryant of Bessemer, Ala., has instructed the Public Utility Board, which operates the municipal electric system, to institute proceedings to force removal of Birmingham Electric Company's properties from Bessemer. The Mayor contends that Beco is operating without a franchise, its 30-year franchise having expired about seven years ago.

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Court Upholds PUDs

The Washington State Supreme Court has upheld the right of the Lincoln, Okanagan, Grant and Douglas county districts to condemn property of Washington Water Power Co. The court affirmed the right of the PUDs to condemn parts of the company's transmission system that extend beyond their borders.

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Voters Reject Power Plan

Voters of Long Beach, Calif., decisively rejected at a special election on March 8 an amendment to the city's charter proposing authorization by majority vote of revenue bonds to buy or enlarge city utilities. The count showed 19,424 votes against and 3,001 in favor.

POWER CONFERENCE—Seen during the Midwest Power Conference in Chicago last week. L to r, Alfred Iddles, Babcock & Wilcox Co.; N. S. Moore, Joslyn Manufacturing & Supply Co., F. E. Andrews, W. S. Davis and E. A. Armstrong of Public Service Co. of Northern Illinois, and J. H. Buell, Middle West Service Corp. and S. L. Reeves, Westinghouse Electric & Manufacturing Co.

Asks SEC to Set Policy for Industry Integration

Commonwealth & Southern President says nation-wide plan is essential to avert arbitrary and chaotic unscrambling — Tells commission that act directs study be made to determine factors

The Securities and Exchange Commission was told last week by Justin R. Whiting, president of Commonwealth & Southern Corp., that a nation-wide tentative plan of integration for all utility holding company systems is essential if the commission is going to avert "an arbitrary and chaotic" unscrambling of utility properties to carry out the "death sentence" provisions of the utility act.

Appearing before the SEC as hearings were resumed on the C. & S. tentative plan as proposed by the commission's utility staff, Mr. Whiting stated "it was a business man's approach to the problem confronting the utilities in complying with the act."

Size of System

One of the major points at issue in the C. & S. case is the size of the system. Under section 30 of the act the commission was directed to make public "studies and investigations of public utility systems . . . to determine the type, sizes and locations of public utility companies which do or can operate most economically and efficiently in the public interest."

Mr. Whiting stated that whether or not the commission is legally required to comply with Section 30 before forcing a compliance with Section 11(b)(1)—the "death sentence"—it is impracticable to carry out the intent of Congress for the integration of the utility industry unless such study be made and published and the commission assume leadership in this field.

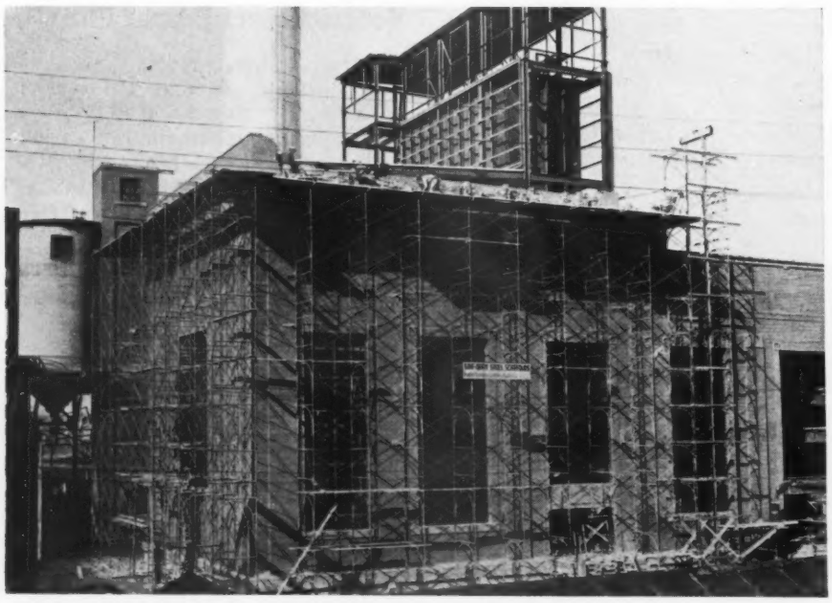
The proper place to determine the most effective size of a utility system is not in a lawsuit, Mr. Whiting told the commission, but is in a study made by a governmental body assisted by the industry. He pointed out that the southern system of C. & S. has a generating capacity less than that already installed and under construction by the TVA and less than that planned for Grand Coulee and Boulder Dam. "If it is economically sound and in the interest of consumers and the public for the government in its operations to construct properties of the large size they are now doing," Mr. Whiting said, "does it not follow that it is likewise economic for smaller private systems to be maintained. If this is not true, then it must be assumed that one economic rule should be applied to public operation and another rule to private operation. Such an application in the end can only result in the taking over by public operation of all the privately owned companies."

Corporate Simplification

Mr. Whiting asked the commission to appoint a compact committee of representatives of the government, directed to work with representatives of the industry selected by the commission and with outstanding independent engineers and economists also so selected. The committee would prepare and submit in an advisory capacity a plan of utility integration and a determination of the criteria and standards in keeping with the purposes of the utility act and the present critical national situation.

SEC feels that the first action by C. & S. in meeting requirements of the utility act is simplification of its corporate structure. In this respect SEC has ordered the company to show cause on May 1 why an order should not be entered requiring the simplification of its corporate structure. The SEC stated that the corporate structure of C. & S. is "unduly and unnecessarily complicated" and that "voting power is unfairly and inequitably distributed among security holders of the holding company system." Object is to eliminate dividend arrearages on the preferred stock and have but one class of stock—common—in the corporate structure. Another view is to split the present system into a northern and a southern system.

The company has indicated that wholesale dismemberment of the system would be fought in the courts.



NEW ADDITION—Southern Colorado Power Co., Pueblo, is building this addition to its steam plant to house a new 7,500-kw. turbo-generator and one 90,000 lb.-per-hour continuous boiler and auxiliaries. It is of one-unit design. This plant will generate power at one-fourth less coal than the present installation

Colorado Utility Unit Operating Cost Low

The new 7,500-kw. unit which Southern Colorado Power Co. is installing in an addition to the Pueblo plant will generate a given amount of electric power from one-fourth less coal than the present plant, President N. W. Clark states. This has been made possible as a result of research and engineering knowledge put into practice since 1922, when the present plant was placed in service.

When completed the new addition will have a rated capacity of 7,500 kw. with an overload capacity of 9,375 kw., Mr. Clark stated. All equipment is of the latest design and is constructed on the one-unit design, which includes one boiler, one turbine and one generator with all necessary auxiliaries.

The boiler is rated 90,000 lb. per hour

continuous, or 115,000 lb. per hour for a four-hour period. The steam pressure will be 400 lb. per square inch, and it will be superheated to a temperature of 750 deg.

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Westinghouse Plant Seen by Navy Group

Steam turbines under construction at the Westinghouse plant at Lester, Pa., were inspected last week by Assistant Secretary of the Navy Ralph A. Bard and a party of 200 naval officials and industrial leaders. The turbines will drive new aircraft carriers, battleships, cruisers and destroyers for the Navy. The plant is at work 24 hours a day turning out propulsion equipment for the greatest number of ships of any American factory.

The steam turbine division of Westinghouse has a backlog of orders totaling $130,000,000, which covers more than 600 marine turbines which when placed into operation will generate 7,000,000 hp. and land turbines for power plant and industrial use which have a total capacity of 2,400,000 hp. The plant's capacity by July will have been increased two and one-quarter times above the pre-expansion level, it was stated.

R. A. McCarty, vice-president and manager of the turbine division, stated that $10,000,000 is being spent in the plant for new manufacturing shops, machine tools and the reorganization of facilities for defense production.

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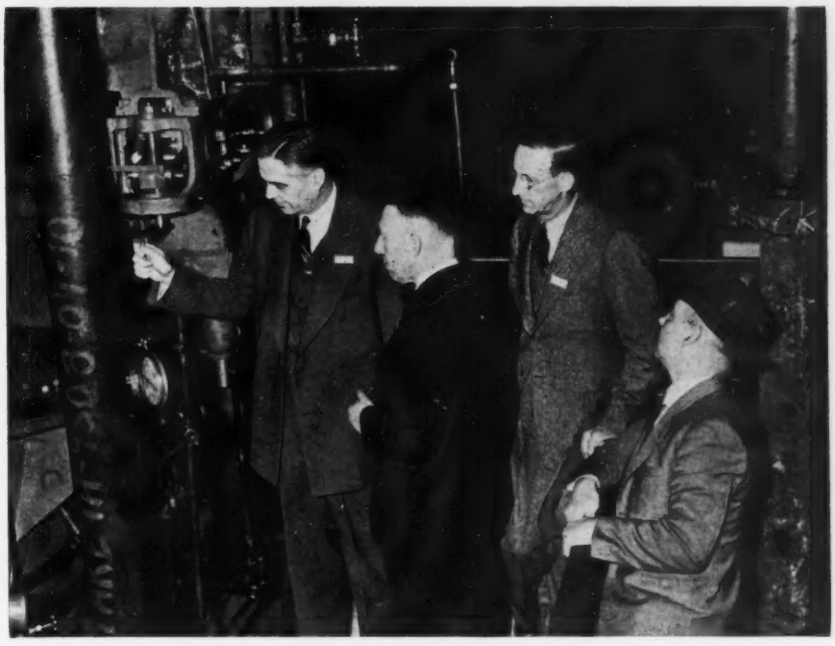
Bellows Falls Case Review Requested

Bellows Falls Hydro-Electric Corp. and the Connecticut River Power Co. have jointly filed with the Federal Power Commission a petition for rehearing on the commission's order and opinion of March 4 requiring a federal license for the Bellows Falls hydro-electric project on the Connecticut River at Bellows Falls, Vermont. At the same time the Bellows Falls Hydro-Electric Corp. filed a motion for stay of the commission's order and a petition for oral argument on the motion to stay, asserting that it is aggrieved in particular by the order requiring that an application for a license be filed on or before May 5, 1941.

In their application for rehearing the respondents set forth their allegations of errors in the findings, order and opinion by which the commission held that the Connecticut River from its mouth up to and beyond Bellows Falls is navigable water of the United States and directed that an application for a license be filed. The commission has 30 days, under the act, in which to act upon the application for rehearing.



VISITS WESTINGHOUSE PLANT—Assistant Secretary of the Navy Ralph A. Bard throws a hand throttle to let steam through a marine turbine on final test at the Westinghouse plant at Lester, Pa. R. A. McCarty, center, Westinghouse vice-president, and G. T. Passmore, manager of manufacturing, look on during an inspection tour of 200 naval officials and industrial leaders

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Rejects Seaway Opposition

The New York Senate, after a debate, defeated by a vote of 20 to 25 the Caffrey resolution which sought to place the Legislature on record as opposing the St. Lawrence seaway projects. Previously the resolution had passed the Assembly.

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Elect Thuerk President

Hugh C. Thuerk, member of the staff of Atlantic Utility Service Corp., has been elected president and director of Bradford Electric Co., a unit in the Associated Gas & Electric System. He succeeds B. M. Kirsch, who becomes executive vice-president of Erie Lighting Co. and vice-president of Pennsylvania Electric Co.

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REAs Subject to Taxation

The state Attorney-General's office for the second time has held that property of Kentucky's 26 rural electrification co-operative associations are subject to taxation.

Districts Show Deficits in Reports to Governor

One of Nebraska's three large public power and irrigation districts, the Loup, and a smaller district, the Middle Loup, in audits filed with Governor Griswold show deficits in operating expenses for 1940.

The deficit for the Loup, hydro division was $215,682 and $7,369 for the rural electrification division. For the Middle Loup the deficit for the year was $26,976, bringing its total deficit to $56,458.

Platte Valley Public Power District had a deficit before depreciation of $55,500 for last year, according to its audit filed with the Governor. It was explained, however, that if the interest on its bonds had been one-fourth of 1 percent for the entire year, instead of for just a few months, the total interest payment would have been only $21,940 instead of $222,713 and the district would have shown a profit before depreciation of $149,223.

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FPC Cites Utah Power

Utah Power & Light Co. has been directed by the Federal Power Commission to produce books of account relating to the original cost of its acquired properties and has set a public hearing for the purpose of investigation to begin on May 5 at Salt Lake City.

Priorities Division Set Up for Utilities

A new priority subcommittee to handle problems of general equipment, including engines, boilers and power plant material, has been set up in the priorities division of OPM. F. A. Schaff, president of the Superheater Co., New York, is head of this group, with J. C. Parker, vice-president of Consolidated Edison Co., as industrial users' representative.

The new committee is an integral part of the Tolls and Equipment Group under Dr. Dexter S. Kimball in the priorities division. Its job will be the handling of individual preference rating certificates for operators working partly on defense and partly on civilian projects. An example of this kind is a power plant in process of construction or expansion in need of nickel steel and small motors.

Such a plant should take its case to the Schaff-Parker committee for a preference rating for that particular project; it cannot by this means get a blanket priority rating for all purchases. Given a priority rating, the power company can certify this rating to its suppliers, who then will give the order preferred status.

The same procedure would apply in the case of a utility needing supplies for ordinary maintenance operations on systems inextricably combined for service both to defense and non-defense customers.

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Cites Pacific Gas on Power Projects

Federal Power Commission has ordered that the Pacific Gas & Electric Co. show cause at a hearing to be held at Washington on April 28 why the commission should not modify or rescind its order of February 19 authorizing the issuance of a license for the construction and operation of the Cresta and Pulga projects on the Feather River in California. A rehearing is granted to the company, which petitioned the commission for modification of the terms and requirements of the license authorized.

The commission's show-cause order states that the company failed to report to the commission, prior to the adoption of an order authorizing the issuance of a license, its construction schedule for certain additional electric generating capacity now planned to go into operation during 1942 and 1943. Following the commission's order authorizing the issuance of a license, the company petitioned the commission for modifications so as to make the license run for 50 years instead of 35 years, as authorized, and for revision of provisions relating to the company's Big Bend power development and reservoir located below the proposed Pulga project.

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Department of Commerce Reorganizes Divisions

The electrical division of the Bureau of Foreign and Domestic Commerce, Department of Commerce, has been abolished in a major reorganization of the bureau, along with the other twelve commodities units of the old setup. John H. Payne, who headed the electrical division, is now an industrial consultant for the bureau, assigned with seven other commodity chiefs to develop special reports on industry, usually the one their former field covered.

Electric utilities, in the reorganization, fall in the Public Utilities Unit of Industrial Economics Division, one of five new branches into which the bureau is now divided. Household appliances are grouped in the Merchandise Unit of this same division, and motive products is one of the tasks assigned to the Finished Durable Goods Unit, also in this division. Thomas E. Lyons, formerly chief of the transportation division, is the new head of the Public Utilities Unit.

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Utility Plans Financing

New York State Electric & Gas Corp. has filed with the New York Public Service Commission a petition for permission to issue $35,393,000 of first mortgage bonds, carrying not more than 3½ per cent interest, and $10,000,000 of preferred stock paying dividends of not more than 5 per cent. Proceeds of the bond issue will be used to retire like amounts of 4½ and 4 per cent bonds of the company, while proceeds of the preferred stock will be used to retire $6,000,000 of 5½ per cent preferred stock and to finance $4,000,000 of new construction.

COMING MEETINGS

Greater New York Safety Council—Annual safety convention and exhibit, New York, N. Y., April 22-25. Greater New York Safety Council, Inc., Lincoln Building, 60 East 42d St., New York.

Missouri Association of Public Utilities—Annual convention Elms Hotel, Excelsior Springs, Mo., April 23-25. Jesse Blythe, assistant secretary, Merchants Bank Bldg., 101 West High St., Jefferson City, Mo.

Illuminating Engineering Society—Pacific Division, second annual lighting conference, Pacific Gas & Electric Co., auditorium, 245 Market St., San Francisco, April 25-26. William P. Bear, general chairman, 245 Market St., San Francisco.

Arkansas Utilities Association—Annual convention, Arlington Hotel, Hot Springs National Park, Ark., April 28-29. R. E. Richie, secretary, Post Office, Box 551, Little Rock, Ark.

Association of Iron and Steel Engineers—Spring conference Youngstown, Ohio, April 28. Brent Wiley, managing director, Empire Bldg., Pittsburgh, Pa.

American Institute of Electrical Engineers—North Eastern District, Rochester, N. Y., April 30-May 2; summer meeting, Toronto, Canada, June 16-20. H. H. Henline, national secretary, 29 West 39th St., New York, N. Y.

Southeastern Electric Exchange—Annual conference, Bon Air Hotel, Augusta, Ga., May 1-3. J. W. Talley, executive secretary, 303 Haas-Howell Bldg., Atlanta, Ga.

Edison Electric Institute—Engineering committees, Edgewater Beach Hotel, Chicago, Ill., May 5-8. Annual convention, Buffalo, N. Y., June 2-5. Major H. S. Bennion, managing director, 420 Lexington Av., New York, N. Y.

National Metal Trades Association—Annual convention, Palmer House, Chicago, Ill., May 8-9. Harry S. Flynn, secretary, 122 S. Michigan Av., Chicago, Ill.

National Electrical Manufacturers Association—Spring meeting, The Homestead, Hot Springs, Va., May 11-15, W. J. Donald, managing director, 155 East 44th St., New York, N. Y.

National Fire Protection Association—Annual meeting, Royal York Hotel, Toronto, Canada, May 12-17. Robert S. Moulton, technical secretary, 60 Batterymarch St., Boston, Mass.

National Electrical Wholesalers Association—Annual convention, The Homestead, Hot Springs, Va., May 18-22. E. Donald Tolles, managing director, 165 Broadway, New York, N. Y.

Pacific Coast Electrical Association—Annual convention, Hotel del Coronado, Coronado, Calif., May 21-24.

Missouri Valley Electric Association—Spring accounting conference, Continental Hotel, Kansas City, Mo., May 22-23. I. D. Pettegrew, director, 1527 Sharp Bldg., Lincoln, Neb.

Empire State Gas & Electric Association—Electric operating group, Van Curler Hotel, Schenectady, N. Y., May 23. George H. Smith, secretary, Grand Central Terminal, New York, N. Y.

Public Utilities Advertising Association—Annual convention, Hotel Statler, Boston, Mass., May 26-27. James Macdonald, chairman, Boston Edison Co., Boston.

National Association of Purchasing Agents—Annual convention, Chicago, Ill., May 26-29. G. A. Renard, executive secretary-treasurer, 11 Park Place, New York, N. Y.

American Society of Heating and Ventilating Engineers—Semi-annual meeting, Palace Hotel, San Francisco, Calif., June 16-19. A. V. Hutchinson, secretary, 51 Madison Av., New York, N. Y.

Pacific Heating & Air Conditioning Exposition—Exposition Auditorium, San Francisco, Calif., June 16-20. Publicity Department, Pacific Heating & Air Conditioning Exposition, Grand Central Palace, New York, N. Y.

American Society of Mechanical Engineers—Semi-annual meeting, Kansas City, Mo., June 16-20. C. E. Davies, national secretary, 29 West 39th St., New York, N. Y.

American Society for Testing Materials—Annual meeting, Palmer House, Chicago, Ill., June 23-27. R. E. Hess, assistant secretary, 260 South Broad St., Philadelphia, Pa.

Canadian Electrical Association—Annual meeting, Seigniory Club, P. Q., Canada, June 25-27. B. C. Fairchild, secretary, 804 Tramways Bldg., Montreal.

Power Output Drops from Preceding Week

A decided drop in electric power production for the week ending April 12 from the preceding week was reported by the Edison Electric Institute. Total output was 2,720,790,000 kw.-hr., as against 2,778,628,000 kw.-hr. the week before, a decline of more than 2 per cent. This was the largest percentage decline reported so far this year and in relation to former years was contraseasonal in many respects.

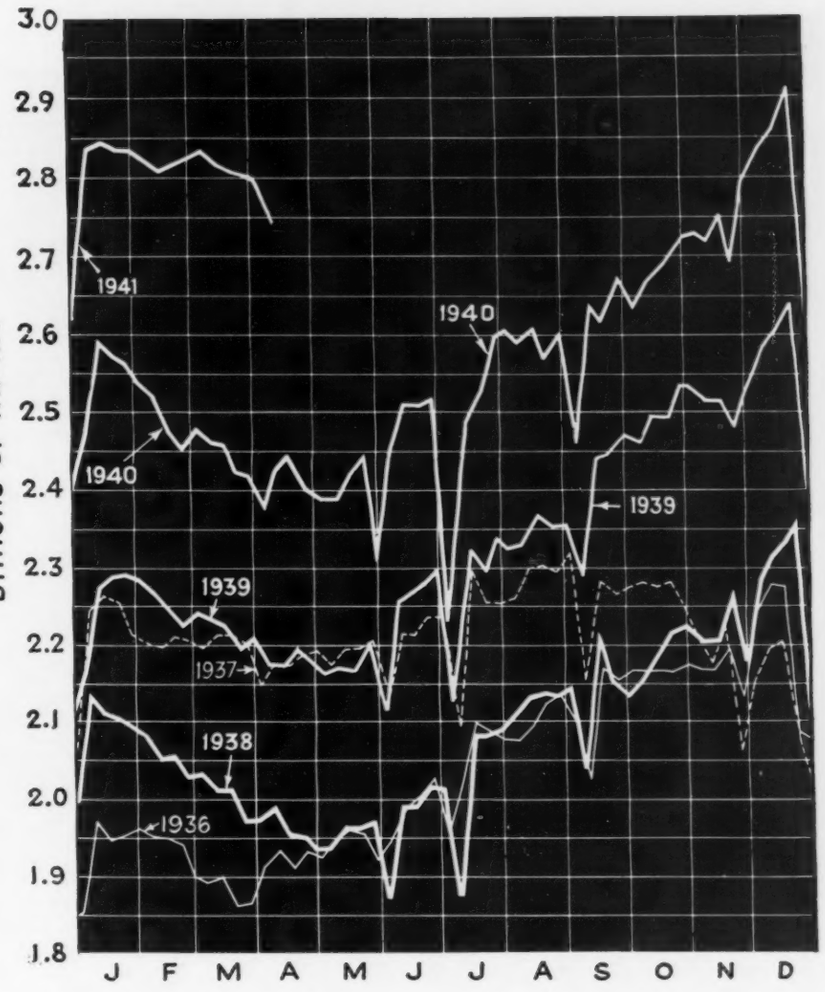
The large number of strikes in industrial plants, the Easter holidays and warmer weather were most responsible. However, there was a gain of 12.5 per cent over last year and a gain of 29.9 per cent over the 1939 figure, the largest gain over a 1939 week reported so far this year.

Weekly Output, Millions Kw.-Hr.

1941		1940		1939	
Apr. 12	2,721	Apr. 13	2,418	Apr. 15	2,171
Apr. 5	2,778	Apr. 6	2,381	Apr. 8	2,173
Mar. 29	2,802	Mar. 30	2,422	Apr. 1	2,210
Mar. 22	2,809	Mar. 23	2,424	Mar. 25	2,198
Mar. 15	2,817	Mar. 16	2,460	Mar. 18	2,225
Mar. 8	2,835	Mar. 9	2,464	Mar. 11	2,238
Mar. 1	2,825	Mar. 2	2,479	Mar. 4	2,244
Feb. 22	2,820	Feb. 24	2,455	Feb. 25	2,226
Feb. 15	2,810	Feb. 17	2,476	Feb. 18	2,249
Feb. 8	2,824	Feb. 10	2,523	Feb. 11	2,268

Per Cent Change from Previous Week

	Week Ending		
	Apr. 12	Apr. 5	Mar. 29
New England	+14.6	+21.6	+19.4
Middle Atlantic	+ 9.3	+13.4	+13.2
Central Industrial	+16.4	+21.7	+19.5
West Central	+14.7	+13.0	+12.4
Southern States	+13.3	+16.9	+20.8
Rocky Mountain	+10.2	+10.0	+12.1
Pacific Coast	+ 8.1	+ 9.8	+ 5.0
Total United States	+12.5	+16.7	+15.7



Only two geographic divisions showed gains over a year ago—West Central and Rocky Mountain—and these were small. The largest drop was reported for New England, with the central industrial region next in line.

Nebraska Utility District Buys Power Properties

All of the electric properties in Nebraska have been sold by Iowa-Nebraska Light & Power Co. to the Consumers Public Power District of Columbus, Neb., for $19,592,000. The district obtained cash for the purchase through the sale of $22,000,000 in revenue bonds, which have been sold publicly through a banking syndicate.

The sale represents the seventh acquisition of utility power properties by the district since last July. The district has offered to sell to the city of Lincoln for $8,620,000 the generating and distributing equipment now serving the city.

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Strike on Pacific Coast

Pacific Electric Manufacturing Co. was among 65 San Francisco industrial plants that closed last week when 1,500 members of AFL machinists' union struck for higher wages. Major point at issue is a new scale, the union seeking $1.25 an hour, against the present rate of $1. Pacific is engaged upon several government contracts vital to the defense program. Pelton Water Wheel Co. was also closed. Hope of early settlement rests with mediation efforts undertaken by government conciliation service.

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Utility Gets FPC Order

Federal Power Commission has ordered that Iowa Union Electric Co. of Keokuk, Iowa, formerly Keokuk Electric Co., show cause at a public hearing in Washington on April 28 why adjusting accounting entries should not be made in accordance with recommendations submitted by the commission's staff following a survey and report on the company's proposed reclassification and original cost studies as prescribed in the commission's Uniform System of Accounts.

Illinois Electric Sales

Total sales of electricity to ultimate consumers by the eleven largest Illinois electric utilities during February, 1941, as compared with the totals for the corresponding month last year, revealed a 5.9 per cent increase in revenue, a 9.2 per cent increase in kilowatt-hours and a 2.3 per cent increase in the number of customers. Revenue amounted to $15,648,862, kilowatt-hours to 738,624,343 and number of customers 1,982,821.

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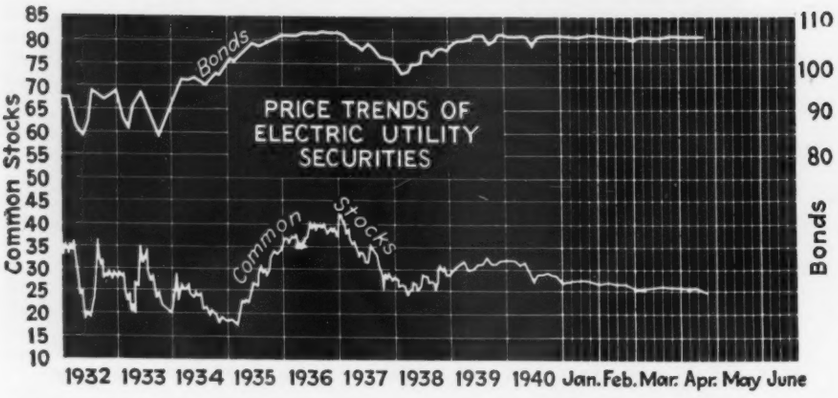
Ebasco Services

Ebasco Services, Inc., service organization of the Electric Bond & Share Co. system, has filed with the SEC a proposal to reduce its authorized capital stock from 26,000 shares to 20,900 shares for the purpose of reducing working capital, upon which the company is permitted to earn a return from $1,760,000 to $1,250,000.

Utility Stocks and Bonds Lose Ground


PRICE TRENDS OF ELECTRIC UTILITY SECURITIES
Bonds
Common Stocks
Common Stocks
Bonds
85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10
110 100 90 80
1932 1933 1934 1935 1936 1937 1938 1939 1940 Jan. Feb. Mar. Apr. May June

Prices of utility securities moved downward during the past week. "Electrical World" stock index dropped to 24.7 from 25.7 the preceding week; last year, 31.5. Changes in the bond list were not as sharp, 106.0; last week, 106.1

Raise $271,941,300 in First Quarter

New issues of electric light and power securities during the month of March totaled $87,560,300, compared with $149,881,000 in February and $35,176,300 in March, 1940. Pacific Gas & Electric Co. and Ohio Power Co. were large participants in the new financing last month—Pacific Gas issued $20,000,000 of first and refunding mortgage bonds and Ohio Power disposed of $20,240,300 preferred stock and $15,000,000 first mortgage bonds. The financing was long-term.

For the three months ended March new electric light and power issues amounted to $271,941,300, compared with $215,404,600 for the similar period of 1940.

Allows New Issues; Limits Dividends

Florida Power Corp. has been authorized by the Securities and Exchange Commission to issue and sell privately $3,000,000 of bonds and debentures for refunding outstanding debt and to finance new construction.

In approving the financing, however, SEC restricted the payment of common stock dividends by the company and stipulated that 15 per cent of gross revenues must be set aside annually for maintenance and for providing a reserve for renewals, replacements and retirements of property. The commission added that it might be necessary for it to consider thoroughly the question of adequacy of the company's depreciation reserve.

Securities to be issued consist of $2,000,000 of 3½ per cent serial debentures due February 1, 1956, and $1,000,000 first mortgage 4 per cent bonds, series C, due December 1, 1966. Bonds are being sold at 104 1/5 and debentures at par to John Hancock Mutual Life Insurance Co.

"We view with disquietude the failure to finance the construction through an increase in the common stock investment in declarant," said the commission. "The issue is of continuing importance because of contemplated large scale new construction program."

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Competitive Bidding

SEC has issued an order that, beginning May 7, all issues of public utility securities amounting to more than $1,000,000 must be sold by competitive bidding. Exceptions include short-term paper and securities issued in connection with liquidation or reorganization. The rule will apply when securities are sold to private investors.

Utility Reports

	Net Income 1941	1940
*Alabama Power	$3,259,696	$4,023,798
*Central Ariz. Lt. & Pwr.	829,445	856,717
*Central Maine Power	2,144,166	2,115,574
*Carolina Power & Light	3,940,772	2,367,840
*Connecticut Lt. & Pwr.	4,207,062	4,051,436
*Dallas Power & Light	2,083,741	1,606,122
*Georgia Power	4,805,811	4,794,021
†Gulf States Utilities	2,427,192	2,663,583
*Houston Ltg. & Pwr.	2,952,621	2,746,863
*Oklahoma Gas & Electric	2,541,472	2,829,605
*Texas Electric Service	1,244,700	1,449,059
*Texas Power & Light	1,978,054	2,238,234
*Utah Power & Light and subs.	2,040,141	1,410,196

* Twelve months ended February 28.
† Twelve months ended January 31.

New Issues of Electric Light and Power Securities in March

Name of Company	Amount (Par Value)	Offered to	Period (Yrs.)	Class	Purpose	Interest Rate	Price	Per Cent Yield
Central Electric & Telephone Co.	$5,000,000	Placed privately	25	First mortgage and collateral trust, series B	Refunding	3¾	105	3.45
Glen Rock Electric Light & Power Co.	325,000	Placed privately	25	First mortgage bonds	Pay note, open account indebtedness, new construction	3½	100	3.50
Ohio Power Co.	15,000,000	Public	30	First mortgage bonds	Property additions, construction	3	102¼	2.88
	20,240,300	Preferred stockholders and public	..	Cum. preferred stock	To redeem preferred stock, discharge open account indebtedness	4½	108	4.16
Pacific Gas & Electric Co.	20,000,000	Public	29	First and refunding mortgage bonds, series J	General corporate purposes	3	101¾	2.91
Public Service Co. of Oklahoma	16,000,000	Public	30	First mortgage bonds, series A	Refunding	3¼	103½	3.07
	8,350,000	Prior Lien stockholders and public	..	Cum. preferred stock	Refunding	5	105	4.76
Kansas Electric Power Co.	2,645,000	Preferred stockholders and public	..	Preferred stock	Refunding	5	103	4.85
Total	$87,560,300							

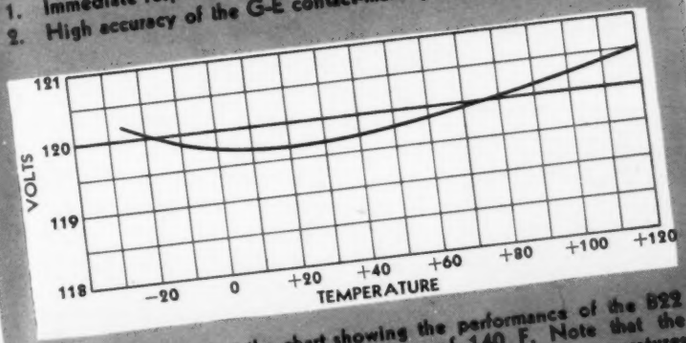
= 500 KVA

That's the EXTRA load-carrying capacity you get on a typical feeder with G-E INDUCTION REGULATORS*

WHY G-E INDUCTION REGULATORS Hold a Narrower Band Width

The closer regulation of the G-E induction regulator is based primarily on

1. Immediate response—without time delay—to voltage changes
2. High accuracy of the G-E contact-making voltmeter



For example, look at the chart showing the performance of the B22 voltmeter under temperature variations of 140 F. Note that the maximum error—one-half volt—is approached only at temperatures above 110 F.

Compare this curve with those for other contact-making voltmeters and you'll see one important reason why G-E regulation is better regulation.

YOU get a bonus of one-third or more *additional* capacity when you regulate your feeders with G-E induction voltage regulators. Recent tests show that they hold the effective band width to 2 volts or less, not 4 volts or more as provided by other types of regulation.

The narrower G-E band width permits you to add more load to your present feeders—500 kva uniformly distributed for a typical case—while maintaining the present peak-load voltage difference between the first and last transformer. Or, you can use the band-width advantage to increase feeder length. You may also elect to recover revenue lost because of feeder voltage drops.

These are operating benefits that enable G-E induction voltage regulators to pay you a large extra return on your investment in regulation. Ask your G-E representative to estimate the results you can obtain on your feeders. General Electric Co., Schenectady, N. Y.

★For Engineers Who Like to Do Their Own Figuring:
This typical example is based on a reduction of two volts in band width on a 3-phase, 225-amp, 4-kv feeder of 4/0 conductor; 53-inch equivalent spacing; length, 10,000 feet; load uniformly distributed; power-factor, 90%.

GENERAL ELECTRIC

404-19-5400

OPERATING PRACTICES

Auto Radio Makes Good Test Receiver

By T. S. BAILEY*
Wisconsin Electric Power Company, Milwaukee

Prime requirement of a radio-noise test receiver, now as in the past, is that it be capable of reproducing the noise as heard on the customer's receiver. This requirement determines the practical value of a test receiver for general field radio noise location work.

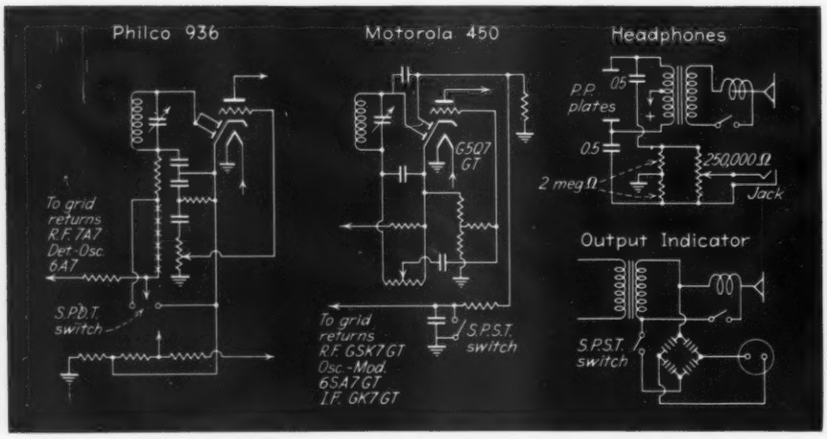
The sensitivity of late-model commercial and broadcast radio receivers is great, and in some cases it has been extended far beyond necessary requirements. This calls for a radio-noise test receiver of the superheterodyne type with a high gain resonant input into a stage of radio-frequency amplification preceding the first detector. The better-quality automotive receivers now available at list prices around $50 meet this specification and certain models of farm or battery-operated receivers approach it and can be recommended for most practical radio-noise location work with one necessary circuit change which removes the automatic volume-control feature. This can be done by any competent radio technician, who should arrange the circuit change so as to provide a manual selection by means of a suitable switch.

Provision of a visual indication of the output is desirable and can be accomplished by switching the secondary of the output transformer so as to feed the speaker voice coil, and/or a copper-oxide rectifier which in turn is connected to an 0–1 d.c. milliammeter. Provision for headphones and calibration of gain control in arbitrary units are other desirable additions which will be of value in the field.

Definite handicap of test receivers of this type is that they are a permanent fixture of the mobile unit and cannot be conveniently carried into the customer's house. A self-contained portable receiver of the popular type is the answer to this problem and it will also be found useful in checking for radio noise on circuits where it can be coupled close, such as next to distribution arrester ground wires.

Other incidental pieces of equipment useful in the location of radio noises are a sledge or mallet to be used in vibrating poles, a $\frac{3}{8}$-in. hand line to clear mid-span contacts between conductor and guy wires and a pencil-type neon indicator to be used in spotting hot pole top hardware.

* Abstract of paper recently presented before Wisconsin Utilities Convention.



CIRCUITS to guide removal of automatic volume control in adapting automotive or battery-operated radio receivers for use as radio-noise test units

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Truck Winch and Reel Remove Line Wire

Pedestrian and live-wire hazards usually associated with overhead wire removal have been practically eliminated and cost of wire withdrawals and labor have been materially reduced through the use of a power-driven reel developed in accordance with suggestions submitted by a line foreman of Public Service Electric & Gas Co. (N.J.), through the company's suggestion plan.

Utilizing this equipment, which makes use of the conventional line truck winch, one line crew, consisting of foreman, four linemen, two ground men and truck driver, working on congested city streets, withdrew approximately 100,000 ft. of 250,000-circ.mil bare and No. 4/0 weatherproof conductors in 22 working days. During the past two years more than 700,000 ft. of conductors have been removed from the open-wire plant with this method.

The equipment makes use of a large sprocket gear which is fastened to a standard reel and equipped with four adjustable clamping arms that

THE FIRST *Plastic* Radial-wave Reflector

★ CHIP-RESISTANT ★ RUSTPROOF ★ LIGHT WEIGHT ★ EASY TO CLEAN ★

★ AMAZINGLY STRONG ★ CORROSION-RESISTANT ★ HIGH REFLECTIVITY ★

HERE'S a reflector light in weight, yet remarkably strong; one that will not rust, corrode, or tarnish under the toughest service conditions anywhere. Advance proof of its performance, ability to stand up against weather, sunlight, rain, and snow without warping, has been obtained from test installations in all parts of the country.

The smooth, hard, lustrous, Glyptal enamel finish—dark green on the top and pure white on the underside—will remain unmarred for years. And, when required, the finish can be restored to original efficiency with a new coat of Glyptal enamel. Mild soap and water is all that is needed to keep the surface brilliantly clean.

Within the last few years there has been a steady parade of G-E street-lighting equipment "firsts"—newly designed products that meet the most exacting demands for reliability, sustained efficiency, and minimum maintenance expense. This new plastic radial-wave reflector, molded from Textolite, is the most recent.

If you are looking for a way to eliminate rusty, chipped, unsightly luminaires—and get more for your street-lighting dollar—look into this new plastic reflector. The low price will interest your purchasing department. Prompt deliveries are being made from stock. General Electric, Schenectady, New York.

Description	Cat. No.	LIST PRICE Each
20-inch, standard dome	6685704	$6.00

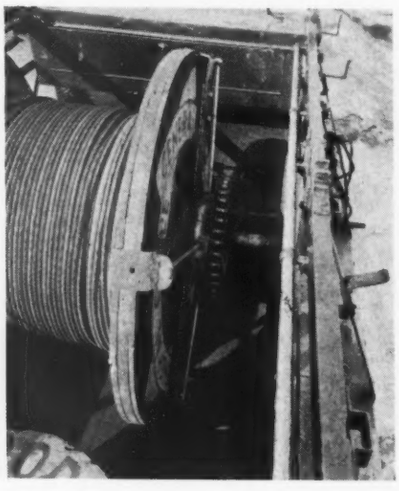
GENERAL ELECTRIC

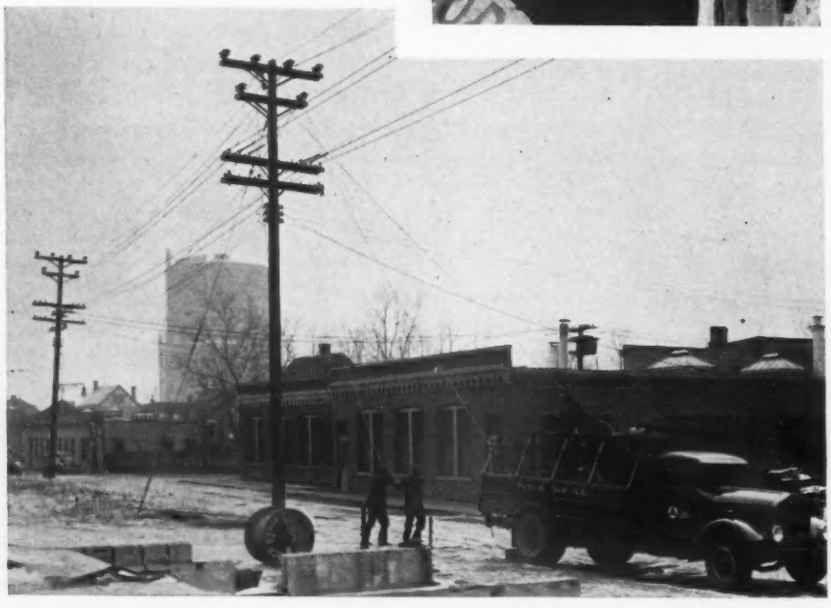
center the gear on the reel and accommodate several sizes of reels. This reel-and-gear assembly is supported on an axle in sleeve bearings mounted in heavy channels that are installed upright in, and supported by, the truck body. A small gear replaces the head of the truck winch and a chain drive from this gear to the reel sprocket gear furnishes the rotating power.

When wire removal is to be done, the line truck is parked at one end of the open-wire circuit. Conductors to be removed are opened approximately thirty sections away—provided the circuit run is reasonably straight—ties are removed and the conductors lowered to the crossarms. At the pulling end one conductor is lowered and securely fastened to the reel on the truck. A second conductor on the opposite side of the crossarm is tied to a ¾-in. rope which is run through blocks and trailing hooks at the rear of the truck to form a friction snub. The two conductors are then spliced at the far end of the line, forming a loop which is held at the far pole by two snatch blocks fastened to the ends of the crossarms supporting the conductors that are to be removed.

As the reel is rotated by the chain drive from the winch, it pulls in the wire which has been secured to it. The second conductor, forming the opposite side of the loop, moves away from the truck, through the snatch blocks at the far end and back to the reeling-in point, carrying with it the rope to which it has been tied. By regulating the friction snub on this rope the wire end is prevented from falling into the working circuits below. When the first pull has been completed, the wire has been replaced by a continuous loop of rope. The open ends of the rope are tied and the rope secured to the truck by a snatch block on either side, forming a continuous belt through the pulling area.

The remaining conductors are withdrawn one at a time by lowering the pulling end to the truck where it is spliced to the end of the wire previously reeled. The far end of the conductor is tied to the rope belt, as before, so that as the conductor is reeled in the rope belt moves in its circuit. Tension of the rope belt to prevent sagging of the conductor is adjusted by moving the truck. When the last conductor has been removed the rope belt is withdrawn by conventional methods.





OVERHEAD wire removal is facilitated, safety improved and cost lowered with the use of equipment which utilizes a wire reel in a line truck driven by chain drive from truck winch to a sprocket gear on reel, as shown in close-up. In the general view workmen are removing discontinued 26-kv. transmission circuits

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Dead-End Clamp for Three-Way Poles

By C. TROUT
General Foreman Transmission Maintenance
Cincinnati Gas & Electric Company

A new type three-way dead-end clamp which has been in service on many of the lines of the Cincinnati Gas & Electric Company for the past year has demonstrated its ability to:

1. Reduce construction costs by 25 to 50 per cent.
2. Provide greater climbing clearances for live line maintenance.
3. Decrease the amount of material and equipment to be maintained.
4. Facilitate pole moving necessitated by street improvement.
5. Improve line appearance.

Dead-end construction of three-way poles on tap lines is usually of two types. The pole type is made by dead-ending all conductors on the pole for each of the three line directions. The buck-arm type dead-ends the branch circuit on a buck arm below the line arms while the main line is supported on a double arm.

This construction is difficult to maintain by live-line methods because of the close clearances and numerous jumpers, and the cost of construction is high because the number of dead-ends requires considerable line material. Also, when a three-way dead-end tap pole has to be relocated, for whatever reason, the expense of labor is usually very high.

The clamp that we have been using is a malleable casting having a groove and keeper for the line conductor and several holes for the dead-end at various angle positions of the line tap. This groove permits an angle of the tap from 75 to 105 deg. with the main line. An increase of 60 deg. is possible by use of the additional holes provided, making the total possible angle of the tap with the main line 45 to 135 deg.

The conductor groove will accommodate conductors of No. 4 to No. 4/0 copper and No. 4 to No. 0 A.C.S.R. inclusive. The main line conductor is supported by the clamp which is attached to a single string of suspension insulators similar to

Begins WITH FORMEX*

NO "MUMMY INSULATION" HERE

With Formex wire, G-E engineers were able to "take off the wraps" on random-wound motors. Away went organic "mummy" coverings and heat-enclosing compounds. Having Formex wire, G-E engineers built a stronger, tougher motor insulation.

Extra Protection

against electrical breakdown

When you're looking for a longer-lasting motor—one that won't wilt and weaken after years of strenuous service, or fail you in an emergency—you want the Tri-Clad motor with its *inner strength.*

When G-E engineers designed the Tri-Clad motor, they saw that the toughness of Formex wire insulation opened up new opportunities for strengthening the entire coil assembly from the inside out. They utilized new G-E synthetic-resin bonding varnishes to give rigidity and extra resistance. They fortified the slot-cells. They welded internal connections.

Finally, they selected for application on end turns a coating of Glyptal No. 1201 Red as an additional armor against the many adverse operating conditions commonly found in industrial service.

Thus, in the Tri-Clad motor you get a more compact winding—one that dissipates heat quickly and keeps the motor young.

With double-end, "controlled-velocity" ventilation and advanced electrical design throughout, the Tri-Clad motor's tougher coil windings mean extra years of service. Next time you order induction motors. . . . make sure they are Tri-Clad motors. General Electric, Schenectady, N. Y.

Integral-hp sizes up to 20 hp (at 3600 rpm), open or splashproof, are now available—also capacitor-motors in sizes up to 5 hp.

Write for our new Tri-Clad motor bulletin, GEA-3580

Extra Protection

against operating wear and tear

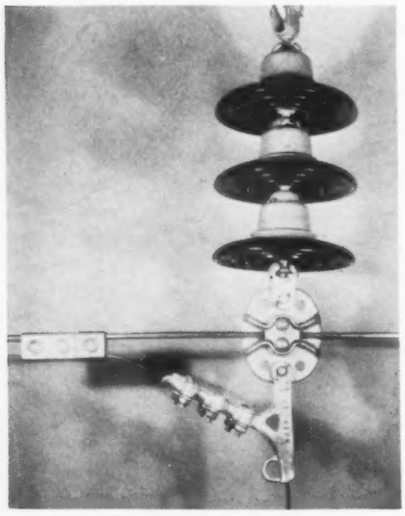
Sleeve bearings of new design have longer life, greater capacity, improved lubrication features. One-piece cast-aluminum rotor winding, with fans cast integrally, is practically indestructible. Sealed ball bearings retain lubrication, exclude dirt.

GENERAL ELECTRIC

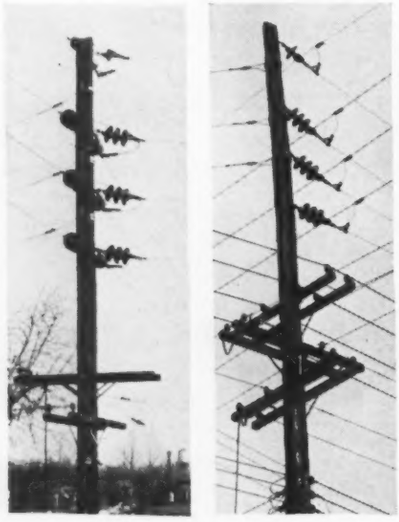
750-50-8058

ordinary swing-out corner construction. Also dead-ended to the clamp is the strain clamp on the tap conductor. The tap jumper is attached to the main conductor by a connector clamp.

This type of construction not only eliminates the objections from the standpoint of line maintenance but also effects considerable savings in construction costs, since all crossarms and most of the dead-ends are eliminated. A reduction of from 25 to 50 per cent in construction costs can be secured by use of the new clamp in place of the other style dead-end constructions. In actual figures, the cost of material required for installation of the new type clamp on a 13.2-kv. tap is $43 less than for a three-way dead-end installation. On a 66-kv. construction a saving of $97 is effected. When these figures are added to a proportional reduction in labor charges the result is a great saving on each installation.



NEW TYPE three-way dead-end clamp for tap lines cuts construction cost one-fourth —makes for safer live line maintenance, simplifies pole relocation



NEW DEAD-END construction for three-way poles on top lines improves pole top appearance

Note absence of jumpers with new construction (left) over old (right). Note also reduction in hardware required.

•

Hints on Selection, Use of Reactors—I

By L. E. SAUER
Westinghouse Electric & Manufacturing Company, Sharon, Pa.

Since reactors are constantly called on to withstand voltage stress between winding and ground, their electrical properties are of primary importance. Unless power circuits and reactors are well protected against surges dielectric tests should not give lower results than those in the accompanying table. Even then surge shunts for the reactors may be advisable if the circuit characteristics are likely to produce overvoltage oscillations, or if high-speed interruptions may force current zero to occur too far ahead of normal frequency zero.

The coil conductor should be insulated to withstand a one-minute test of 1,500 volts between it and a 1-in. pipe electrode for protection against small conducting materials that may fall or be drawn into the coil. Cable insulation cannot be considered as part of the major insulation and no reduction of clearance to ground should be allowed because of it.

Conducting material paralleling the creepage surface of the winding is undesirable. Such materials, even though they have sufficient solid insulation between them and the winding to withstand full test voltage, should be separated from the winding. This applies to cell wall materials such as concrete, brick or masonry, as well as metal. All should be considered as being at ground potential in establishing clearance between them and reactor parts.

Since the reactor is purchased primarily to limit the current which will flow under short circuit, the electrical property which accomplishes this end—the ohms impedance—should have as small a negative variance as possible. A tolerance of —3 to 7 per cent of the desired figure should satisfy most conditions of operation. This is suggested because a closer tolerance than 10 per cent total may increase the reactor price and time of manufacture without materially benefiting the purchaser.

All electrical connections should be welded or brazed. Where bolted connections are made to coil terminals silver-plated contact surfaces are the best, because silver oxide is a conductor. Next best are copper-to-copper surfaces cleaned of copper oxide, scored and coated with petrolatum jelly. Flatness of the contact surfaces is of no importance, since anything short of an optical flat will have no more than several point or spot contacts. Some operators favor tinned contact surfaces and sweat their connections together in addition to bolting them.

Ed Note—This is the first of two articles. The second will discuss the mechanical and thermal properties of reactors.

One-Minute Test Voltages for Current-Limiting Reactors
Sphere Gap Measurements RMS Calibration

Rated Line Voltage	Coil to Ground	High Frequency Induced Between Coil Terminals Indoor	Outdoor
1,200	12,000	12,000	25,000
2,500	25,000	25,000	30,000
5,000	30,000	30,000	40,000
8,660	40,000	40,000	55,000
15,000	60,000	60,000	85,000
25,000	85,000	85,000	115,000
34,500	115,000	115,000	115,000

•

Cost of Oil-Fused Cutout Job

An Eastern utility handling a considerable number of distribution system improvement jobs in 1939 records the following costs (here given for estimating use) of installing three oil-fused cutouts and 100 ft. of cable in a transformer crib:

Labor		$166.21
Liability insurance and payroll tax		8.86
Transportation		25.93
Stores expense		19.74
Materials:		
100 ft. No. 00 single-conductor varnished cambric, lead-covered cable	$20.00	
24 ft. single-conductor, 5-kv. wire	3.60	
Three 150-amp. oil-fused cutouts	157.41	
Six fuse links	2.09	
Two 3-position arms	1.22	
Four porcelains	1.04	
Miscellaneous hardware	12.04	
	$197.40	197.40
Total		$418.14

1 Long Life-Contacts. Extra-heavy RS-1045 elkonite. In the eight years Allis-Chalmers Step Regulators have been on the market, not a single contact has ever been replaced due to deterioration under normal operation!

2 Quick-Break Mechanism with simple, sturdy, balanced-spring construction gives high-speed contact separation without the use of motor or brake with their attendant maintenance.

3 Feather-Touch Control permits closer band width settings . . . eliminates the need for auxiliary holding devices on the voltage control relay.

4 Integrating Contactor eliminates over-shooting . . . holds voltage smoother with narrower band width setting.

5 Reduced Maintenance Costs! There are fewer moving parts to get out of order . . . no stuffing boxes, shafts or mercury seals. And complete oil-immersion of driving motor and operating mechanism makes lubrication unnecessary.

CONNECTED TO THE TRANSFORMER BY A BUS-ENCLOSING throat are the nine vertical lift switchgear units of this Type UST Unit Substation designed for multi-circuit service on the lines of a far western utility.

NEWS
OF ENGINEERING DEVELOPMENTS

New Steam Plant to Use Man Lift

Quick servicing and inspection in a power plant means work on as many as five floors. That's why the general superintendent of an eastern utility recommended the installation of Allis-Chalmers Man Lifts in their new plant. To go up, a man steps onto the upside elevator, pulls the rope that controls the start, and is quickly hoisted to where he wants to go.

Steps with conveniently placed hand-holds are spaced at about two-second intervals along the continuous rubber belt. Two electrical switches are the only controls used — one that starts and stops the elevator at any point and the other a safety switch in case a passenger fails to get off at the top floor.

At speeds as great as 100 feet per minute, these lifts can get men to the top of the boiler or down to the condenser hot wells when every second counts. According to the general superintendent, the time saved in one emergency shutdown might easily pay for the entire installation.

After the Flood . . .

The great Ohio River flood of 1937 completely inundated the warehouse in which an Ohio utility had a large stock of distribution transformers of varied manufacture.

When the water subsided several days later, all the transformers except the Allis-Chalmers units had to be completely reconditioned before they were fit for service. On the other hand, the Allis-Chalmers Distribution Transformers . . . oil-filled and oil-sealed . . . were ready to be put on the lines immediately.

UNIT SUBSTATIONS

INDUSTRIAL ENGINEERING

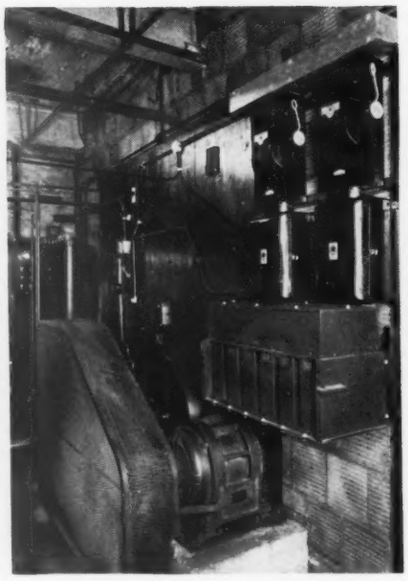
Capacitors Avert Transformer Overload

By W. P. COOK
Akron, Ohio

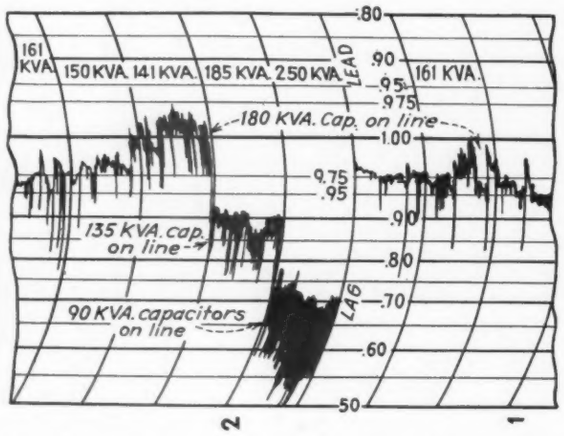
At the Bridgewater Machine Company, in Akron, a very interesting application of capacitors has just recently been completed in order to unload the service transformers. A few years ago this plant installed 90 kva. in static capacitors in order to correct power factor, not only to unload transformers but also to reduce power costs. During the past year the load has practically doubled, which has reduced average power factor even with 90 kva. in capacitors to around 65 per cent and has overloaded three 50-kva. transformers approximately 25 per cent.

It was determined that in order to correct the power factor from 65 to 95 per cent it would be necessary to install an additional 90 kva. in capacitors to make a total of 180. If this amount of capacitance were left on the line when the plant load was down the leading current would be in excess of the transformer rating, and some method had to be devised to connect the additional capacitors to the line only when the plant was operating.

This plant has two 30-hp. air compressors, both of which are used during heavy operating periods and one during light operating periods. Consequently the new 90 kva. in 460-volt capacitors was split into two units of 45 kva. each. These capacitors were connected to the three-phase power supply through 90-amp. contactors and 100 amp., three-pole fused disconnect switches. The operating coils of the contactors were connected to the load side of the air compressor starter, so that as soon as the air compressor was started the contactor immediately closed and connected the capacitors to the line. When the plant shuts down the capacitors are disconnected from the line as soon as the air compressors go off.



CAPACITOR automatically disconnected when compressor shuts down



CANCEL 100 kva. with capacitors. The wide swings are caused by loading and unloading of two 30-hp. compressors

Line Current Reduced

It was determined that this plant's power factor without the installation of any capacitors and disregarding the lighting load was about 46 per cent. With 90 kva. in capacitors floating on the line constantly the average power factor was about 65 per cent and with the addition of the new 90 kva. the power factor has been increased to 95 per cent at the time of maximum demand. Without any power-factor correction the power demand would be in the neighborhood of 250 kva. With 90 kva. connected the total power demand was approximately 190 kva. and under present conditions, with 180 kva. in capacitors, the demand is approximately 131 kva. Due to the fact that only three 50-kva. power transformers are installed it can easily be determined that the load could not be carried without any capacitors, inasmuch as the transformers would be overloaded 67 per cent. Even with 90 kva. in capacitors the transformers would still be overloaded 26 per cent. With the additional 90 kva. the load has been reduced and will allow an increase of 13 per cent before the

A wide range of consistencies available for any method of application or operating condition.

YEARS of exhaustive research by Gulf's technologists have produced two superior lines of lubricating greases for ball and roller bearings — greases which provide a "second wind" for today's hard pressed equipment.

One, Gulf Anti-Friction Grease, is recommended for heavy duty service. The other, Gulf Precision Grease, is recommended for lighter duty and higher speeds. Both have a high melting point and are specially prepared for greatest resistance to oxidation and separation.

Gulf's newly developed method of compounding, employing special high pressure kettles and mixing methods, produces these greases with a relatively smooth, non-fibrous texture, which gives a true picture of their consistency.

Both of these superior new lubricants are available in a standardized consistency range in line with the National Lubricating Grease Institute consistency recommendations which went into effect March 1, 1941. Write today for complete information.

GULF INDUSTRIAL LUBRICATION

Gulf Oil Corporation - Gulf Refining Company EW
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Please send me without obligation complete information about your new long life greases for anti-friction bearings.

Name.....
Company.....
Address.....

Floodlights Guard Stock, Avoid Investment

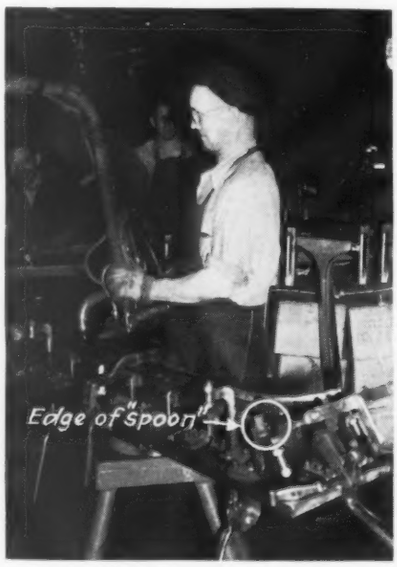
Southwestern Iron & Metal Company, Wichita, Kan., is making storage yard floodlighting pay double. Instead of buying a second shear to cut scrap metal during heavy demand periods the company has put in floodlighting and works its one shear double time, one daylight shift and one shift under the lights. Protection against thieves is the other way the company makes the lights pay for themselves. One watchman can now guard the yard as effectively as several. To light the yard, as shown, one 1,500-watt floodlight was installed in the front of the yard for protection and three 1,500 watt floodlights were put in at the rear to give light for night work, thus combining the functions of lighting for production and for protection.

transformers are up to their normal rating. The capacitor installation was considerably cheaper than the cost of additional transformer capacity that would have been required. The capacitor installation has reduced the power bill by at least 17 per cent and the latest installation will pay for itself within a twelve-month period on savings in power cost alone.

•

Eliminate Weld Burrs With Copper "Spoon"

To eliminate the need for grinding burrs from depressions that result from spot welding certain Nash automobile body parts, Seaman body division of Nash-Kelvinator Corporation has mounted copper strips or "spoons" along the edges of jigs holding parts to be welded. The spoon, which is usually made of copper strip $\frac{3}{8}$-$\frac{1}{2}$ in. thick, bears on the side of the welded part that is to be free of burrs. One electrode of the gun welder is placed against the copper strip and the other against the remaining exposed surface of the metal being welded. The large bearing surface of the spoon distributes the electrode pressure over a wider surface and eliminates one of the two depressions that characterize all spot welds by providing a flat copper surface against which the inside point can force spot-melted metal, while cooling. This eliminates the outside point denting hot metal and helps eliminate shrinkage in point areas.



COPPER "spoon" eliminates necessity of grinding after spot welding of parts

These spoon coppers serve a double purpose when used to clamp parts in exact position while welding on conveyorized fixtures, in which case excess dents and burns, from odd positions of guns, are avoided. Discoloration of the welded metal due to heating is not entirely eliminated by this technique.

•

Portable Switch House for Strip Mine

Portable outdoor switch houses are used at Tecumseh Coal Corporation's new strip mine near Dickeysville, Ind., to control and protect the 4,150-volt feeder circuits to the electric stripping and loading shovels (ELECTRICAL WORLD, page 1174, April 5). These houses, which weigh about 1 ton, are easily dragged about the area by a team of mules as the locations of the stripper and loader change.

Each switch house—three are used—consists of a self-supporting welded angle iron structure entirely steel-inclosed and mounted on steel sled runners. Both the front and back have hinged steel doors and a portion of each side is removable to allow access to equipment in the house. The roof is pitched to shed the rain and both inside and outside are covered with white aluminum paint.

Each house contains a group-operated three-pole, single-throw disconnecting switch connected on the line side of a 600-amp., 7,500-volt, manually operated, 25,000-kva. rupturing capacity oil circuit breaker, operated from the front of the steel panel on which the apparatus is mounted. Two 110-volt lamps, connected to the secondary of the same potential transformer that energizes the shunt trip coil on the breaker, light the inside of the house. Cables for connecting to the pole line supply are carried on a rack on the side of the house when it is moved from one location to another.

Engineers from the Tecumseh organization and Westinghouse cooperated in the design of the switch houses.

Suppose This Happened!

THINK what would happen to American industry if the Electrical Wholesalers' hands were tied for a week, or even for a single day.

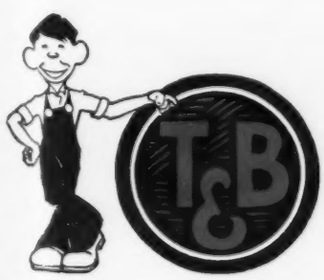
Who would do their work?

Who would keep taking the millions of different electrical products off the hands of the thousands of manufacturers, and keep putting them into the hands of a country full of Users?

It is theoretically conceivable that *all* the electrical manufacturers *might* sell all their products direct to all the Users, but the sales costs obviously would be fantastic. Users would rebel. Chaos in the industry would result.

We are firmly convinced that the only economically sound system of distributing electrical products is through Wholesalers.

For this reason, every sale of every T & B product absolutely must go through the capable hands of some experienced T & B Distributor whose ideas of service are in tune with our own.



THE THOMAS AND BETTS CO., INC.

MANUFACTURERS OF ELECTRICAL FITTINGS SINCE 1899

T & B Distributors cover United States and Canada

Factory, Engineering and Executive Offices, Elizabeth, N. J.

Sales and Service offices in 25 leading cities

NEW ENGINEERING IDEAS

Guide to 50-F.C. Fluorescent Lighting

When planning for 50 foot-candles of fluorescent lighting, the use of the accompanying guide, developed by the Nela Park Engineering Department of General Electric Company, will simplify the problem of estimating the number of 40-watt white Mazda F lamps required. (If 40-watt daylight fluorescent lamps are used about 20 per cent more lamps are needed to secure an average illumination in service of around 50 foot-candles. Due to depreciation of lamps and fixtures, the initial foot-candle level will be appreciably higher.)

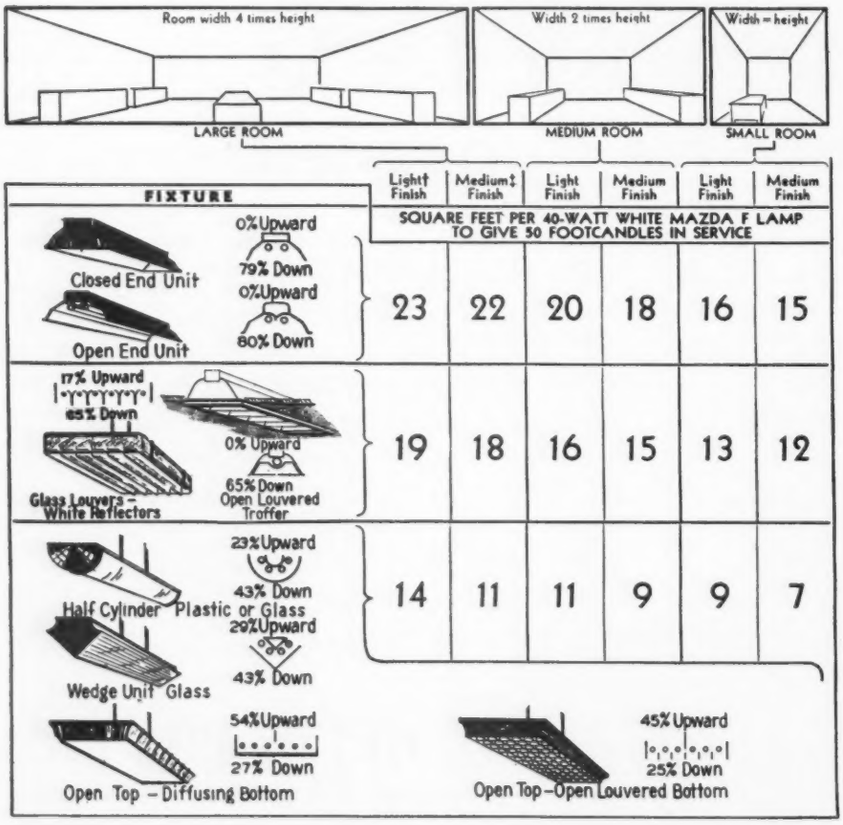
Stated briefly, the guide may be used in this way: Divide the total square feet to be lighted by the value from this table to determine the number of 40-watt white fluorescent lamps to be used. Knowing the number of lamps per fixture, the number of lamps required can thus be quickly calculated.

For example, assume that six-lamp, open-top, diffusing-bottom units are to be used to light a store 30 x 70 ft. with a 13-ft. ceiling and light walls and ceiling. Here is the procedure:

Number lamps required for 50 foot-candles:

$$\frac{30 \times 70}{11} = \frac{2{,}100}{11} = 191.$$

Number of fixtures $\frac{191}{6} = 32.$



FIXTURE	LARGE ROOM Light† Finish	LARGE ROOM Medium‡ Finish	MEDIUM ROOM Light Finish	MEDIUM ROOM Medium Finish	SMALL ROOM Light Finish	SMALL ROOM Medium Finish
	SQUARE FEET PER 40-WATT WHITE MAZDA F LAMP TO GIVE 50 FOOTCANDLES IN SERVICE					
Closed End Unit (0% Upward, 79% Down) / Open End Unit (0% Upward, 80% Down)	23	22	20	18	16	15
17% Upward, 65% Down — Glass Louvers – White Reflectors (0% Upward, 65% Down Open Louvered Troffer)	19	18	16	15	13	12
Half Cylinder Plastic or Glass (23% Upward, 43% Down) / Wedge Unit Glass (29% Upward, 43% Down)	14	11	11	9	9	7
Open Top – Diffusing Bottom (54% Upward, 27% Down)						
Open Top – Open Louvered Bottom (45% Upward, 25% Down)						

ESTIMATING number of 40-watt white fluorescent lamps for 50-foot-candle installations involves only two calculations if this guide is used

"Light finish" means light ceiling (75 per cent) and wall (50 per cent) finish. "Medium finish" refers to medium ceiling (50 per cent) and wall (30 per cent) finish.

•

Better Transformers From New Steel

By H. V. PUTMAN
Manager Transformer Division
Westinghouse Electric & Manufacturing Company, Sharon, Pa.

In its first application, "Hipersil"—high permeability silicon steel—has reduced size and weight of distribution transformers as much as 25 per cent; it has effected reduction of copper losses some 10 per cent, and thereby increased short-time overload capacity. These improvements in distribution transformers have been accomplished by the improved magnetic characteristics of the material, including one-third greater flux-carrying capacity than commercial silicon steel, together with a reduction in magneto-striction, the principal cause of hum.

For its increased flux-carrying capacity, this new material, the product of nine years of research, depends on the magnetic orientation of its crystals in the direction the steel is rolled. By this orientation, the permeability is increased in this direction

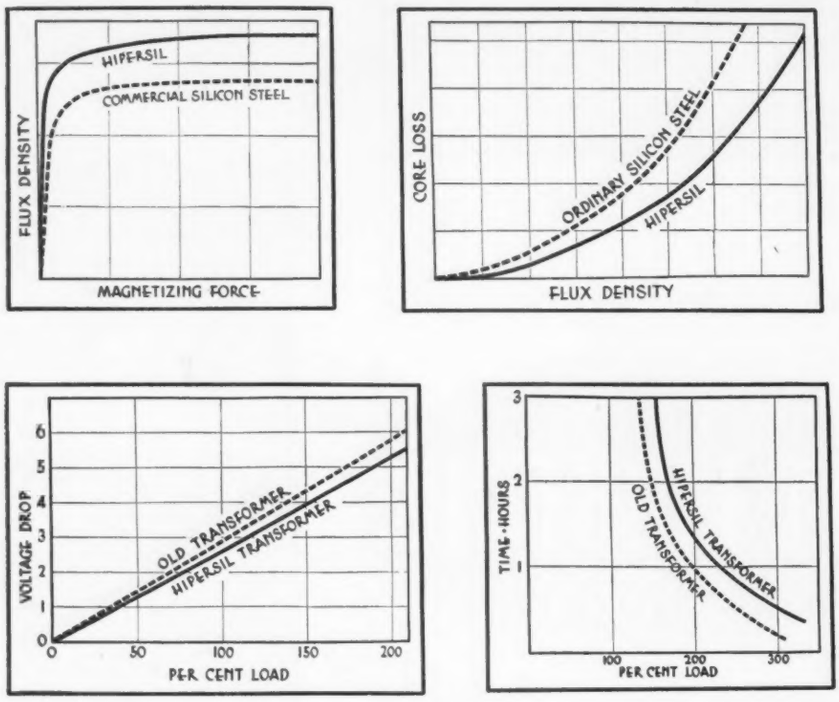
Tonight, and every night

L-M LIGHTING

is increasing visibility, decreasing accidents, protecting lives on streets and highways all over America . . . and saving many dollars annually by its economical maintenance. These photographs from many states are the proof . . . you get effective, modern lighting when you depend on L-M for "Everything You Need In Street and Highway Lighting".

LINE MATERIAL COMPANY

GENERAL OFFICES • MILWAUKEE, WISCONSIN



TRANSFORMER improvements effected by application of new silicon steel

Higher permeability of material gives it its name of "Hipersil." Knee of saturation curve for new material is about one-third higher than for commercial silicon steel (upper left). It has lower core loss than ordinary silicon steels at same flux densities (upper right). Voltage regulation is improved, especially in smaller distribution transformers. Regulation curves (lower left) are for 2,400-volt, 10-kva. units operating at 0.80 power factor. Load-time curves for 10-kva. units (lower right) show new transformer carries substantially more load for a given time to reach a temperature rise of 55 deg. C. in the winding.

and its flux-carrying capacity is thereby increased about one-third over conventional hot-rolled silicon steel.

Because the material can be worked with same excitation to higher induction than ordinary silicon steels, the size and weight of transformer cores can be reduced; fewer turns of copper are needed and thus less iron, copper and oil can be used. The unit can be placed in a smaller tank.

Greater flux-carrying capacity of the material can be used by the designer in two ways to improve the voltage regulation. Shorter average length of turns in the winding, and consequently lower copper resistance, reduces copper loss and voltage drop at unity power factor, while shorter mean turn and fewer number of turns give lower reactance, which reduces voltage drop particularly at low power factor.

The magnetic circuit of a "Hipersil" transformer makes ventilation of the winding easy, so the temperature gradient between coils and oil can be reduced. Since copper losses for a given load are decreased, the quantity of heat generated in the winding is lessened, and a greater short-time overload can be carried without exceeding safe operating temperature.

•

Cutting Interference From Fluorescents

By A. C. HOYLE*
Wisconsin-Michigan Power Company,
Iron Mountain, Mich.

Early in the conception of the fluorescent lamp a small condenser was incorporated in the auxiliary to reduce radio interference below objectionable levels. This proved effective since 18- and 24-in. lamps were used in the main. With the wider use of these lamps, however, even the low level of radio interference produced was a source of annoyance. The problem has become more apparent with the 36- and 48-in. lamps because of the high level of radio interference these lamps produce. For these reasons the following preliminary recommendations for the reduction of radio interference from fluorescent lamps are presented.

* Abstract of paper presented at recent Wisconsin Utilities Association convention.

Interfering energy of broadcast frequency emitted by fluorescent lamp discharge may reach the radio receiver in one or more ways:

1. Direct radiation from the lamp to aerial circuit.
2. Direct radiation from electric supply line to aerial circuit.
3. Line feedback from lamp through service line to radio.

Direct Radiation—Energy transmitted by direct radiation from the lamp is easiest to eliminate as it is usually dissipated within 5 or 10 ft. Greater distance of energy travel is often due to transmission or reflection of radio energy from metallic surroundings, such as piping steel work, wiring or other fixtures near the lamp. This can be controlled by proper location of the radio and its aerial with respect to the lamp.

Where the radio can't be located out of range of direct radiations:

1. Locate the aerial out of the direct radiation range and connect to the radio by means of a shielded lead-in with grounded shield or install "doublet type" aerial with suitable leads.
2. Provide a good low-resistance ground.

In severe cases, where appearance is not a consideration, interference may be reduced by shielding the entire lighting unit with a grounded copper screen.

Line Radiation—The electric supply line to the lamp may act as an antenna to radiate interfering radio energy to the receiving set through its aerial circuit. With most fluorescent lamp installations the interference field around the supply lines corresponds roughly to that of the direct radiation from the lamp, and when precautions have been taken to reduce direct lamp radiation line radiations will also be eliminated, provided the radio aerial is located far enough from the supply line.

Line Feedback—Because of the high impedance of the line to currents in the frequency range concerned this energy is often dissipated before it reaches the radio. The greater the length of line from lamp to radio the less the interference from the line feedback. Ideal arrangement for elimination of interference transmitted by line feedback, as well as line radiation, would be to place an inductive-capacitive filter at each lamp. Function of the filter is to suppress radio energy and by-pass it to ground. It is often found that a simple capacitive filter will take care of two or more lamps if installed properly.

Discard all your previous conceptions of transformer value

Judge the L-M ROUND-WOUND Transformer on the basis of its correct design and these performance factors →

1 better regulation at all power factors
2 better ratio of losses
3 lower exciting current
4 uniformly high impulse strength
5 high short time overload capacity

It is an acknowledged fact that transformer engineers have long sought a method whereby an inherently correct combination of coil-and-core assembly and its resultant efficiency could be achieved and produced economically.

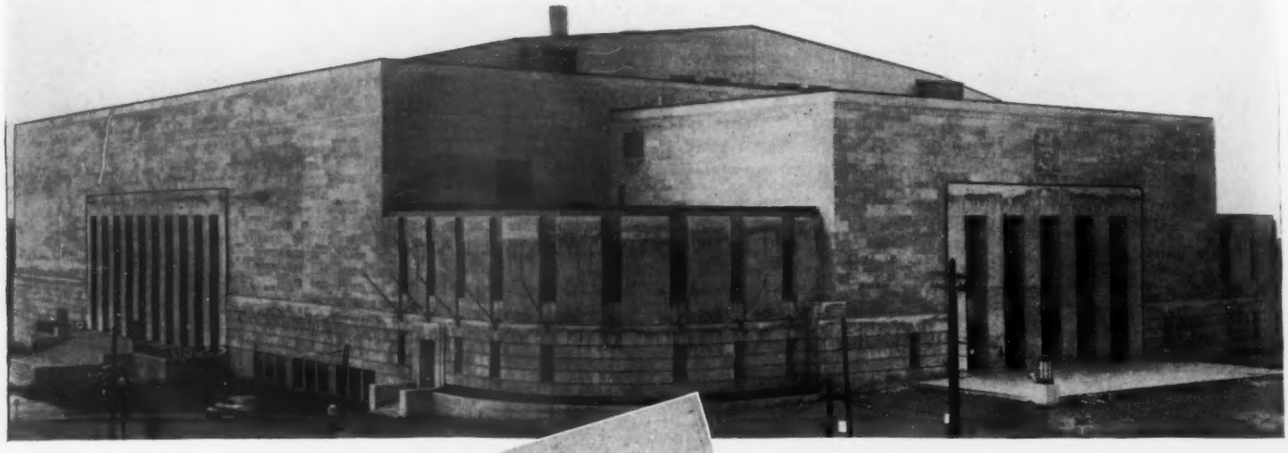
L-M engineers have done it. True, there have been other attempts which have been partially successful. But, for the first time, you are offered the ultimate in the L-M ROUND-WOUND Transformer.

Full details and convincing proof regarding it will be found in the new booklet available through your L-M representative or by writing to the General Offices at Milwaukee, Wis.

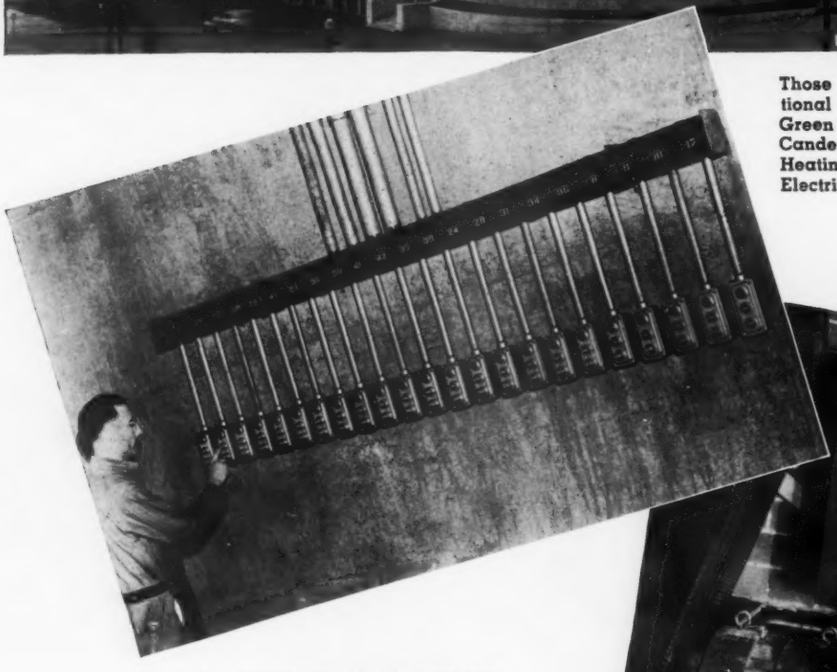
LM

LINE MATERIAL COMPANY

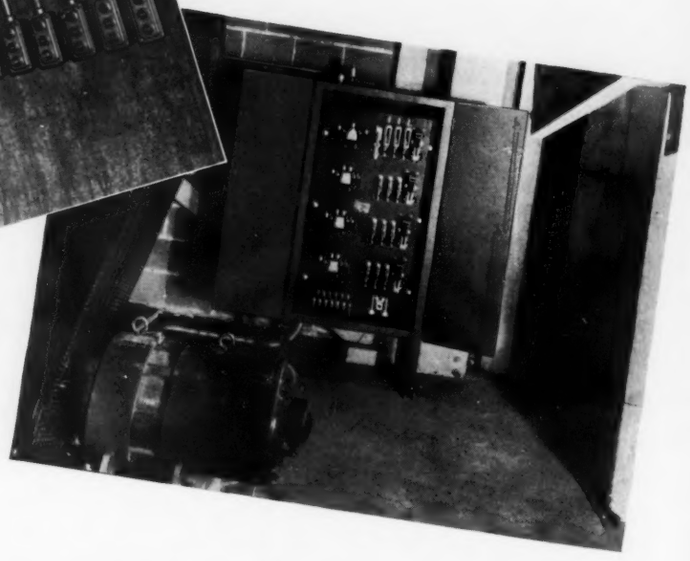
Buffalo's New Memorial Auditorium



Those responsible for the architectural and functional success of this outstanding structure include: Green & James (Buffalo) Architects . . . Beman & Candee (Buffalo) Engineers . . . E. J. Leary (Buffalo) Heating Contractor . . . Buffalo Electric Co., Inc. Electrical Contractors.



An open installation of 23 start-stop push button stations with pilot lights controlling combination across-the-line starters on various fans throughout the building.



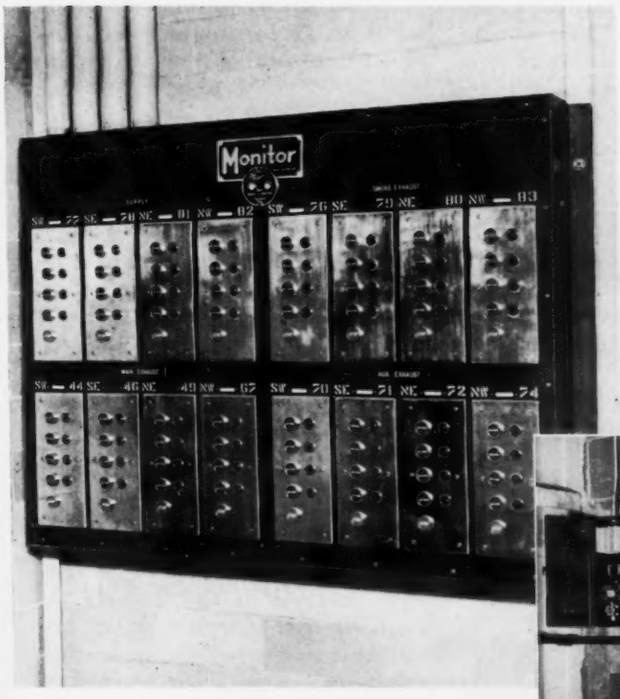
Showing one of the Monitor Panels . . . operated remotely from engineer's office.

Monitor Makes

CONTACTORS PUSH BUTTONS RHEOSTATS
CONTROLLERS RESISTORS STARTERS

Boasts the Latest in Electrical Equipment Plus Monitor *"Finger-tip" Control*

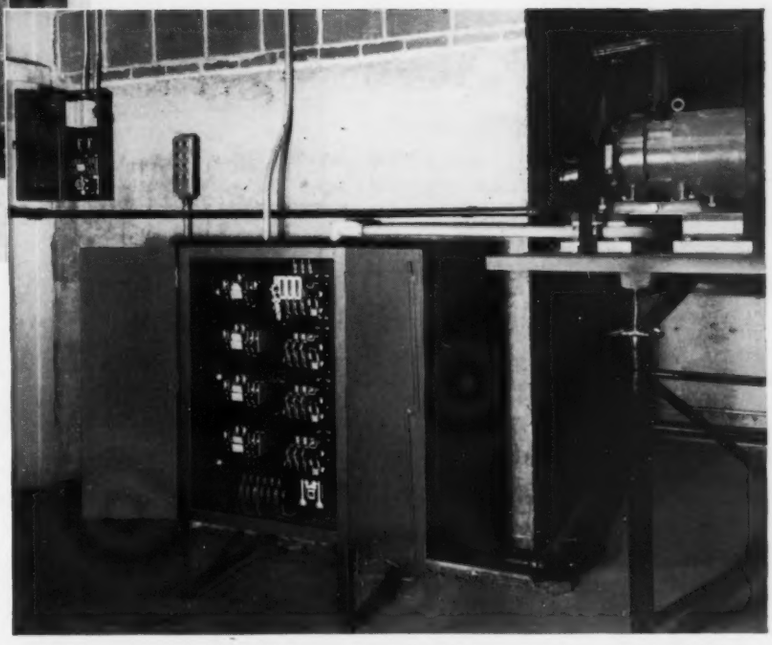
The vast size of this notable structure, and the complexity of its heating and ventilating systems puts a heavy burden of responsibility on the electrical control devices. *Monitor's* reputation for long-term dependability made it first choice of those in charge of this installation—which, undoubtedly, is the largest of its kind anywhere—comprising as many fully automatic controllers on fans for speed regulating from remote points. . . . The operating engineer has expressed complete satisfaction with the layout and performance of his Monitor control system. Our engineers can assist you with control problems of equal or lesser importance. Write us today.



An assembly of 16—9005 stations on one panel in the engineer's control room which regulate the speed of fans at remote locations.

Monitor
BALTIMORE, MD.
The Original
JUST PRESS A BUTTON System

A Good Installation Deserves **Monitor** *Control*



Another piece of Monitor Control equipment. Several motors are controlled from this one panel.

TheMonitorControllerCompany

GAY, LOMBARD & FREDERICK STS. BALTIMORE, MARYLAND

LOAD BUILDING

2c. Space Heating Can Be Cheap

By KNIGHT C. PORTER
Air Conditioning Department,
Commonwealth Edison Company, Chicago

Utility men, as well as heating engineers, have for some time accepted as a fact that electricity for space heating must be priced less than 1 cent per kilowatt-hour to be competitive with common fuels. It is proposed here to show that this statement cannot be accepted without qualification and to show by a specific example that electric space heating at 2 cents per kilowatt-hour may be cheap *under special conditions.*

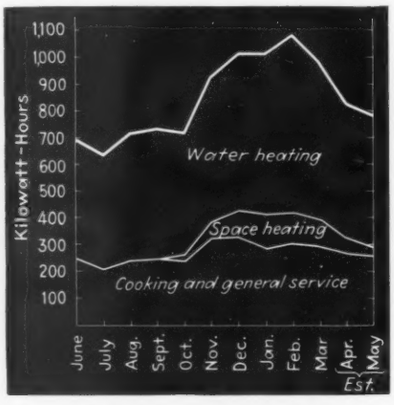
Our case involves a family living in a two-story, six-room house who, finding living conditions crowded, decided to build a maid's room, 15 x 10 ft. with a 7-ft. ceiling, at the north end of an available full-unfinished attic. Since there was 4 in. of rock-wool above the second floor the attic space was colder than normal and it was decided to insulate all walls of the room. The owner of the house was hesitant to add the heating of this room to the thermostatically controlled gravity hot water system because:

1. The boiler had little spare capacity.
2. Addition of another radiator to one of the two headers would tend to unbalance the rest of the heating system.
3. Availability of heat for the new room would be entirely dependent upon demands on the first floor, where the thermostat was situated.

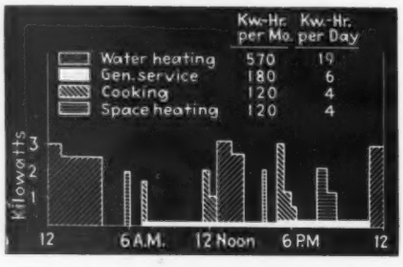
Because of these objections the owner decided to attempt electric space heating as prime heat. A manually controlled 2-kw., two-heat, built-in, forced-air heater was selected which provided 2.5 watts per cu.ft. Total cost of the installation was $78, which included $60 for the heater and $18 for a separate 240-volt circuit. This cost is probably lower than would be needed for an extension of the hot water system.

Three meters were installed to keep a record of performance—a recording ammeter, a watt-hour meter and a recording temperature and humidity indicator.

Records showed that the rate of heat gain varies with the extremity of the outside weather. From 1 to 1½ hours is necessary to heat the room from 50 to 70 deg. However, the occupant sitting in front of the warm air discharge was comfortable in a much shorter time. It appears that 2.5 watts per cu.ft. provides adequate pick-up for a 20 deg. rise. Under extreme outside weather conditions, however, requiring a 25 deg. pick-up, the time was a little slower than might be desired and it is thought that 3 watts per cu.ft. should be recommended for this condition.



MONTHLY energy consumption of customer using electric cooking, water and space heating



TYPICAL winter weekday load curve shows diversity of range, water and space heating loads

Consumption records show that a total of approximately 600 kilowatt-hours was consumed during the season (see chart for average daily use). Based on 2-cent energy the cost of heating this room for a winter season will be $12. There is little question that the cost of heating this room from the central heating system would have brought a 10 per cent ($17) increase in the fuel bill. It seems reasonable, therefore, to say that the experience of this heating season proves that electricity at 2 cents per kilowatt-hour has been cheaper than fuel oil in this particular case.

Analysis of the customer's load shows that this application was highly desirable. The customer was using electric cooking and electric water heating. There was little occasion for coincidental use of space heating, water heating and cooking, as is shown by the 24-hour load analysis for a typical winter weekday. The maid did the majority of the cooking, so there was, in essence, a manual throw-over switch between space heating and cooking. When the maid was cooking the heater was not in use. When she was in her room the range was rarely in use. Therefore, for this customer, space heating has proved to be decidedly off-peak and does a nice job of filling in the valleys.

50 Standards for Satisfaction

WHY *Certified*★

FLEUR·O·LIERS

are the key to the best in fluorescent

Certified
FLEUR-O-LIER
The Manufacturer guarantees by affixing this label that this Fluorescent Luminaire is a duplicate of samples found by periodic examination to comply with the minimum requirements as set up in the
"SPECIFICATIONS FOR LUMINAIRES, FITTINGS AND AUXILIARIES FOR FLUORESCENT LAMPS"
which are sponsored by the Manufacturers of Mazda Lamps.
ELECTRICAL TESTING LABORATORIES
NEW YORK, N. Y.
A COPY OF THIS CERTIFICATE SHOULD APPEAR UPON EACH UNIT OR PACKAGE
E.T.L.
FLUORESCENT LIGHTING FIXTURES EMPLOYING EXISTING TYPES OF LAMPS ARE NOT RECOMMENDED FOR SCHOOLS, OFFICES AND SIMILAR LOCATIONS UNLESS LAMPS ARE SHIELDED FROM DIRECT VIEW.
THIS CERTIFICATION IS CONTINGENT UPON EMPLOYMENT OF CERTIFIED AUXILIARIES OF OVER 85% POWER FACTOR

In the brief twelve month's history of Certified★ FLEUR-O-LIERS, an enviable record of minimum complaints and maximum satisfaction to users has been established. The reason? 50 rigid specifications that make FLEUR-O-LIERS the standard of high quality in fluorescent lighting fixtures.

What Do the 50 SPECIFICATIONS Cover?

5 for LIGHTING EFFECTIVENESS
6 for ELECTRICAL SAFETY
18 for MECHANICAL SOUNDNESS
14 for ELECTRICAL EXCELLENCE
7 for AUXILIARY EQUIPMENT PERFORMANCE

Service to the public does not stop with the manufacture of Certified equipment. Members of the Fleur-O-Lier group receive up-to-date bulletined information on development, experiences, uses, engineering problems and other important information developed from the experiences and tests of all manufacturers in the group. This results in constant improvements of units as well as continued new designing of fixtures to fit all types of decoration.

It pays to specify and buy Fleur-O-Lier equipment because it means *Certified* equipment, produced by manufacturers who are systematically supplied with the most up-to-date information on fluorescent lighting.

OVER 40 LEADING FIXTURE MANUFACTURERS PARTICIPATE IN THE FLEUR-O-LIER PROGRAM

All auxiliary equipment (ballasts and starters) is also *certified*—which assures the user of balanced, coordinated operation. The labels and metal stamps shown identify these certified units on shipping boxes and units themselves.

Write today for a free copy of this new booklet

"50 Standards for Satisfaction." If you want this 6" x 9", 12-page, illustrated book in quantities for distribution to your representatives, or to contractors and distributors, you may secure them at 5c per copy—the cost price.

FLEUR·O·LIER *Manufacturers*

Participation in the FLEUR-O-LIER MANUFACTURERS' program is open to any manufacturer who complies with FLEUR-O-LIER requirements

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Please send me FREE new booklet "50 Standards for Satisfaction," together with list of manufacturers

Name _____

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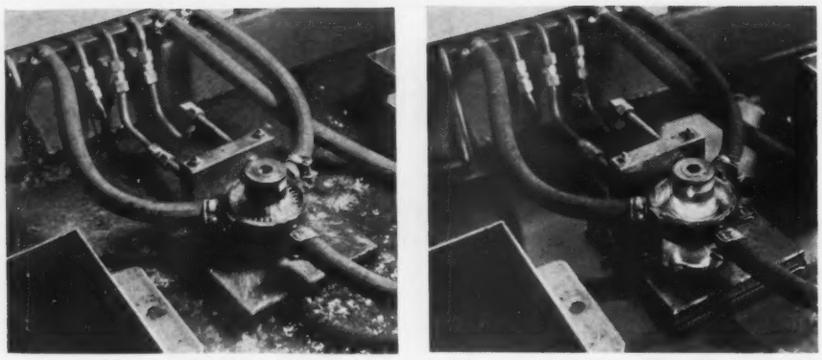


ELECTRIC HEAT for production lines. Inductive heating and split-second quenching cycle combine to step up output from 1,400 pieces per shift to 4,500 pieces

Induction Heating Multiplies Production

By using intensely localized surface hardening provided by a high-frequency electrical installation, the Jacobs Manufacturing Company, Hartford, Conn., has increased the production of its No. 1 chuck bodies from a maximum of 1,400 pieces in eight hours to about 4,500, besides reducing rejects from a former level of 3 per cent to zero.

The area to be hardened is subjected to a 250,000-cycle current produced in the exact spot desired by a surrounding inductor coil which does not touch the piece under treatment. The high-frequency magnetic field produces hysteresis and eddy current heating in a predetermined area which is confined to the surface of the work. The heating takes but a few seconds, and as soon as the desired hardening temperature (about 1,450 deg. F.) is reached, the power is automatically cut off and the heated area is quenched by spraying water under 70 lb. pressure per sq.in. upon the work through orifices in a surrounding jacket.

The work was formerly done at the Jacobs plant by lead hardening, which consumed about three times as much electrical energy as the present process. The latter was developed by the Ohio Crankshaft Company, Cleveland.

The equipment was designed to be located in production lines and the source of high-frequency current is a special converter built into the machine and energized from the 220-volt shop power supply circuit.

The peak load of the unit at the Jacobs plant is about 42 amp. at 440 volts, single phase, and at 85 per cent power factor (capacitors are installed in the shop) the demand is about 15.7 kw. An auto-transformer is integral with the unit. Heating and quenching are automatically controlled within plus or minus 0.05 second, and the power input, duration of heating, quenching pressure and time of quenching can all be pre-set.

Fluorescent for Phoenix Printery

By T. F. McDONOUGH
Central Arizona Light & Power Company, Phoenix

First "engineered" fluorescent installation in Phoenix, Ariz., that at the Republic and Gazette Printery, is winning the customer's approval through the improvement it has given to working conditions. Besides better lighting—both as to distribution and color quality—it has yielded an appreciable reduction in radiant heat.

Designed to produce 30–40 ft.-candles on working surfaces, it consists of 34 "Daybrite" units, each containing two 48-in., 40-watt daylight fluorescent units. Mounting heights are 7 ft. 10 in. and 9 ft. 4 in. to bottom edge of units. The fixtures are on 8-ft. centers sidewise, 10-ft. centers lengthwise.

Connected load approximates 100 watts per fixture, or 3.4 kw. for the installation. Consumption data have not been obtained because the installation is on the same meter with power.

The installation is served through a switchboard which measures 10x7 ft., being composed of 2x12-in. planks. Twenty externally operated switches are mounted on the front, five 60-amp., fourteen 30-amp. and one 100-amp. Feeder conduit is brought in from the back of the board, while eighteen $\frac{3}{4}$-in. and one 1-in. conduits carry branch circuits out from the front of the board.

Using high power-factor "tulamp" ballasts, starting compensators, replaceable starters, the units represent the latest design and have yielded a power factor exceeding 90 per cent.

PRINT SHOP EMPLOYS FLUORESCENT—34 "Day-brite" units provide 30-40 ft.-candles on working surfaces, easing eyestrain in fine typework, eliminating shadows and glare, and greatly improving the quality of color work

"PIPING"

Means to a Power Man!

To most people, "piping" conveys nothing more dramatic than ordinary straight pipe used in heating and plumbing.

But not to a power engineer! He thinks in terms of complex super-piping systems engineered to handle steam at thousands of pounds pressure . . . of special-alloy tubing fabricated to perform exacting chemical processes on a large scale!

When such systems are required today, leading engineers prefer to "give the plans to Grinnell." Pioneers of prefabricated piping, Grinnell engineers accurately interpret layouts into metal . . . prefabricate complete systems in Grinnell's fully-equipped shops . . . and deliver pretested sub-assemblies ready to drop in place.

Super-pipe prefabrication is but one of many Grinnell services. Others include: automatic sprinkler fire protection, Thermolier unit heaters, Amco industrial humidifiers, pipe fittings and pipe hangers. Grinnell Co., Inc., Executive Offices, Providence, Rhode Island.

GRINNELL

WHENEVER **PIPING** IS INVOLVED

Grinnell Company, Inc. • Grinnell Company of the Pacific • Grinnell Company of Canada, Ltd. • General Fire Extinguisher Company • American Moistening Company • Columbia Malleable Castings Corporation • The Ontario Malleable Iron Co., Ltd.

NEW EQUIPMENT

Solderless Lugs

Redesigned line of solderless lugs is available in five sizes, 30-60, 100, 200, 400 and 600 amp., to cover a range of wire sizes, solid, strand or flexible, from No. 14 to 1,000,000 circ.mil. Three intermediate

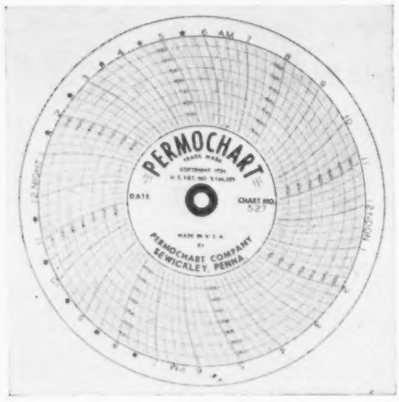
Solderless "Handi-Lug," single cable, No. 4/0 to 500,000 circ.mil. **Trumbull Electric Mfg. Co.**, Plainville, Conn.

sizes, 30, 300 and 500 amp., are also available where a limited range of wire sizes is desired. Lugs have a through opening for inspection and are tightened by socket head wrenches.

•

Instrument Charts

Recent improvements in this company's charts for recording instruments, from which the previous day's record is removed with a damp cloth and the chart reused,



"Permocharts" of Vinylite plastic; for all types of recording instruments using circular charts. **Permochart Co.**, Sewickley, Pa.

include center reinforcement to prevent deterioration, printing and laminating changes to make the charts clearer and keep them from separating at the edges. Charts are guaranteed for daily use over a normal working period of two years.

•

Rectifier Control

Rectifier control for mining service; breakers are equipped with overcurrent and undervoltage tips, have standard ratings from 50 to 600 kw. at 275 and 550 volts, d.c. **Westinghouse Elec. & Mfg. Co.**, East Pittsburgh, Pa.

Rectifier control for mining service is manually operated but arranged so that such features as automatic closing of cathode breaker can be added. Interlocks are provided for addition of second unit. Primary a.c. protective and operating unit contains 25,000-kva. oil circuit breaker, set of three, single-pole, group-operated disconnecting switches and set of current transformers. D.c. switching equipment consists of indicating instruments and manually operated cathode breaker. Multiple-type anode breaker is substituted for use with "sealed off" type rectifiers.

•

Insulated Taps

Gutter taps and other cable taps are available with molded bakelite covers. The

Insulated taps. **Penn-Union Electric Corp.**, Erie, Pa.

line includes parallel and 90-deg. taps and combinations, for conductor sizes up to 1,000,000 circ.mil. They are made with one, two, three, and four bolts, according to size and conditions of service.

Who Makes What?

"Electrical Buyers Reference," published annually. **Electrical World**, 330 West 42d St., New York, N. Y.

Names, addresses and products of electrical manufacturers are catalogued in this convenient, annual publication for public utility, industrial, engineering and other major electrical buying interests.

Temperature Relay

For protection of machines and transformers against overloading, an improved temperature relay is announced. It still serves as the galvanometer in a Wheatstone bridge circuit comprising a resist-

Type "CFT" induction temperature relay. **General Electric Co.**, Schenectady, N. Y.

ance temperature detector in one arm and tapped bridge resistors in the other three arms. Normal operating region of the relay is, of necessity, close to the pickup point. Consequently, the high-torque characteristic of the induction-cylinder feature provides more dependable and more consistent protection, it is claimed. Adjustments will be the same as that of the type ICT induction-disk relay, which is superseded.

•

Industrial Fluorescents

Industrial fluorescent fixtures feature ballast, compensator and wiring permanently located in top channel, as aid to in-

"Vulcan" industrial fluorescent fixtures; one is two-lamp, 100-watt unit and other a two-lamp, 40-watt unit; removable porcelain or enamel reflectors, ends open or closed. **Garcy Lighting Co.**, 4224-46 Lincoln Ave., Chicago, Ill.

"IT MAKES A DIFFERENCE TO ALL ETERNITY WHETHER WE DO RIGHT OR WRONG TODAY" *James Freeman Clark*

AND THAT IS WHY—

UNIFORM HIGH QUALITY

RAW MATERIALS AND GALVANIZING ARE ASSOCIATED WITH *HUBBARD POLE LINE HARDWARE* AT ALL TIMES . . . WHETHER ORDERS ARE FOR FULL CARLOADS IN LUSH PERIODS, OR FOR ONE PIECE DURING THE SLACK SEASON.

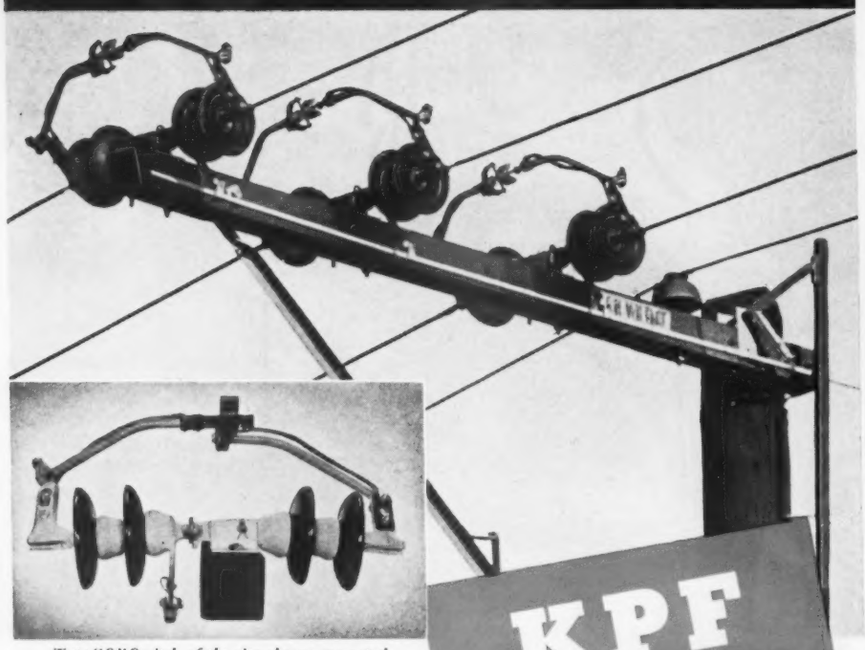
THAT *SPRING CONSTRUCTION* YOU ARE PLANNING WILL SERVE YOUR CUSTOMERS IN THE BEST POSSIBLE MANNER IF IT HAS THE UNIFORM DEPENDABILITY, STRENGTH AND DURABILITY THAT ARE SYNONYMOUS WITH THE NAME HUBBARD.

HUBBARD AND COMPANY

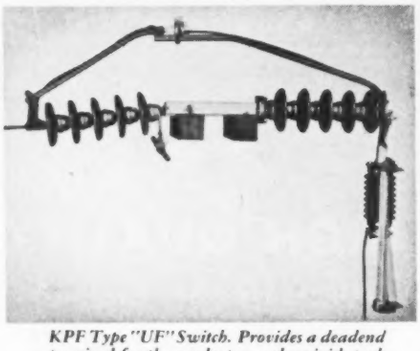
PITTSBURGH . . . OAKLAND CALIFORNIA . . . CHICAGO

"HANG THE LOAD ON HUBBARD HARDWARE"

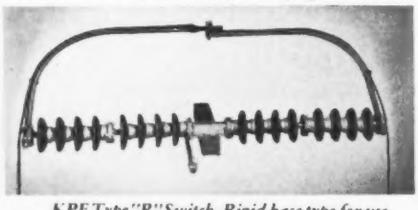
CANNOT BIND BECAUSE OF CROSS-ARM WARPAGE



Type "S" Switch of the size shown mounted on the side arm above.



KPF Type "UF" Switch. Provides a deadend terminal for the conductor and a rigid stack with fuse holder for drop-off.



KPF Type "R" Switch. Rigid base type for use where switch need not operate under line tension. Mounts on single cross-arm.

Contacts in slightly open position. Blade and clip is constructed of heavy copper and have electro-deposited silver contact surfaces for a long life, cool operation.

Contacts in closed position. Standard for KPF switches. Full floating, self-releasing contacts maintain good contact under all conditions of line sag.

KPF SWITCHES *for long trouble-free performance*

Push Pull Interphase rods moving parallel with the cross-arm control the action of all KPF Switches. Switch is opened and closed by simple levers. This method provides complete freedom from binding due to cross-arm warpage.

KPF Type "S" Switches mount on a single cross-arm without the use of extra deadends. Conductor is brought to terminal on switch insulator. The break of the switch is at right angles to the line of the conductor giving a side opening break which is inherently superior for breaking charging or load currents. These exclusive features have been tried and proven superior in actual service over a period of thirty years. High speed, low cost installation, long trouble-free performance, and the greater degree of safety provided make it imperative that you investigate at once.

Write today for FREE catalog. Fully illustrated and with complete technical data this catalog should be in your files for quick reference. Give us details of your problem... let our engineers help.

KPF ELECTRIC COMPANY, 857 HOWARD ST., SAN FRANCISCO, CALIFORNIA

stallation, cleaning and other maintenance. Baked enamel finish used in reflectors is stated to test at 80 per cent reflectivity.

•

All-rubber Plug

Safety is featured in a plug molded of rubber in a single unit. Manufacturer states that the plug is capable of withstanding heavy pressure, that the construction makes it impossible for any metal parts to become exposed, and that it is smaller than conventional triple outlets. Spring friction blades provide tight connections.

Multiple-outlet (cube tap) unbreakable plug. **United States Rubber Co.**, New York, N. Y.

•

Relays

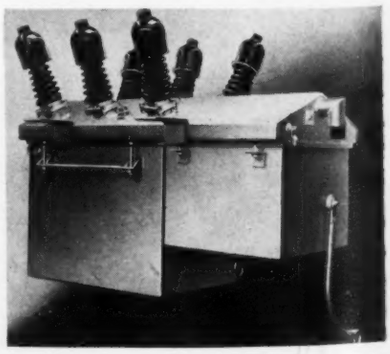
"Dunco" Types "CX3007" and "CXA3008" relays. **Struthers Dunn, Inc.**, Philadelphia, Pa.

Non-welding contacts of these lightweight, vibration-proof relays are said to make them suitable for use with lamps, motors or other devices where high inrush loads may be encountered. Type "CX3007" is single-pole, single-throw with normally open contacts rated 50 amp. at 12 or 24 volts d.c. and will stand an inrush of 100 amp. Larger type "CXA3008" is rated 100 amp. at 12 volts d.c. or 80 amp. at 24 volts d.c., to stand an inrush of 300 amp.

•

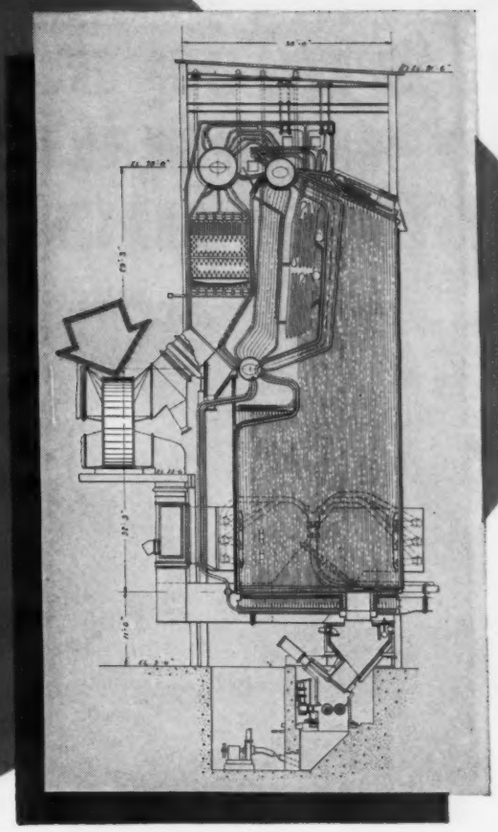
Automatic Service Restorer

Motor-wound, for rural or low-revenue distribution lines, offers unlimited number of reclosures on transient faults. On sustained faults, lockout occurs on the fourth opening. It is said to end long outages, such as may occur where fuse



Service restorer. Rating 15 kv., 100 amp. continuous, 18,000 amp. interrupting. **Pacific Electric Mfg. Corp.**, San Francisco, Calif., and Gary, Ind.

Getting more steam up at Washington



New high-efficiency steam generating units of The Potomac Electric Power Company are equipped with Ljungstrom Air Preheaters

At the Buzzard Point Plant of The Potomac Electric Power Co., new steam capacity is being called into action to meet the increased demands of the Washington area. One modern steam generating unit like this went into service a few months ago; another duplicate unit is fast nearing completion.

Each of these units has a maximum continuous rating of 525,000 lb. steam per hr., 900° F. total temperature. Each is equipped with two horizontal-type Ljungstrom Air Preheaters as an important element in obtaining maximum heat recovery. At capacity operation, gases enter the preheaters at 682° F., leave at 350°, heating combustion air to 530° F.

* * * * *

The unanimity with which Ljungstrom Air Preheaters are being chosen for high-efficiency steam generating units like these is the best evidence of their high thermal efficiency and mechanical dependability. The greater the overall efficiency of the plant, the more likely it is that Ljungstroms have been selected for the final step in heat recovery.

The fact is that more of these compact, heat-transfer units, based on the *continuous regenerative counter flow* principle, are today being installed in power-plants than all other types of air preheaters combined. *Every* leading boiler manufacturer has included them in outstanding installations made during the past year.

Engineering evidence which shows why the margin of advantage is now so definitely on the side of the Ljungstrom is available, based on actual installations meeting conditions similar to your own. If you'd like a chance to check it over, write us today.

THE AIR PREHEATER CORPORATION

Executive Offices: 60 East 42nd St., New York, N. Y. **Plant: Wellesville, New York**

Fluorescent at its Finest by HYGRADE *the pioneers*

IT'S GOOD BUSINESS TO RECOMMEND THE BEST—MIRALUMES!

Hygrade's superior-quality fluorescent fixtures are completely guaranteed!

It pays big dividends in customer-satisfaction to recommend Hygrade MIRALUMES — thanks to this *exclusive combination* of advantages:

Finer light (Hygrade's patented lamp coating) . . . *sure, trouble-free starting* (Hygrade's patented Mirastat starters) . . . *lower maintenance* (Hygrade's easily demountable reflectors and sturdy lamp holders) . . . plus *a complete guarantee* covering every part!

MIRALUMES are *quality manufactured* . . . better designed and engineered . . . sold wired, ready to install, complete with *superior* Hygrade Lamps . . . Underwriters Laboratory approved!

We base our request for your support of our products on the *constructive soundness* of our policies—in constantly improving product quality and in stimulating ever wider interest in better lighting.

NOTE: Extraordinary lighting efficiencies are obtained in Hygrade Fluorescent Lamps by tuning the ultra-violet energy to the 2537 Angstrom Units wavelength effective in causing the porous film (Hygrade Patent #2,096,693) to generate light as shown in Hygrade controlled Patent #2,126,787. Hygrade products are exclusively protected by nearly a hundred other patents, including #2,201,817 and #1,982,821.

EVERY MIRALUME EMBODIES A HIGH POWER FACTOR, LOW STROBOSCOPIC CIRCUIT

Hygrade MIRALUMES

World's Only Completely Guaranteed Fluorescent Lighting Fixtures

Hygrade Sylvania Corp., Ipswich, Mass. Est. 1901. Makers of Hygrade Fluorescent and Incandescent Lamps and Sylvania Radio Tubes

protection alone is used, and thereby to offer better continuity of service. Restorer has outside adjustment of time and current or inverse-time-delay mechanism, manual operation, higher impulse levels, fast arc extinguishment, tripping at lower current and special accessories.

•

Electron Rectifier

New units designed to provide full-wave direct current from a.c. circuits. They are said to be suitable for use with adjustable speed d.c. motors, radio transmitters, battery charging, for exciter current for a.c. generators, synchronous motors, remote-control circuits, and substations, also for electrolytic production of zinc and dissociation of compounds. Listed capacities range from ¼ to 10 hp. for use on 115-230-volt, three-wire, 230-volt, three-phase, and 440-volt, two-wire, a.c., and having

Electron rectifier. **Electron Equipment Corp.**, Palm Springs, Calif.

output of 2.6 amp., 110 volts, to 39 amp., 230 volts, d.c. Units up to and including ½ hp. are portable.

•

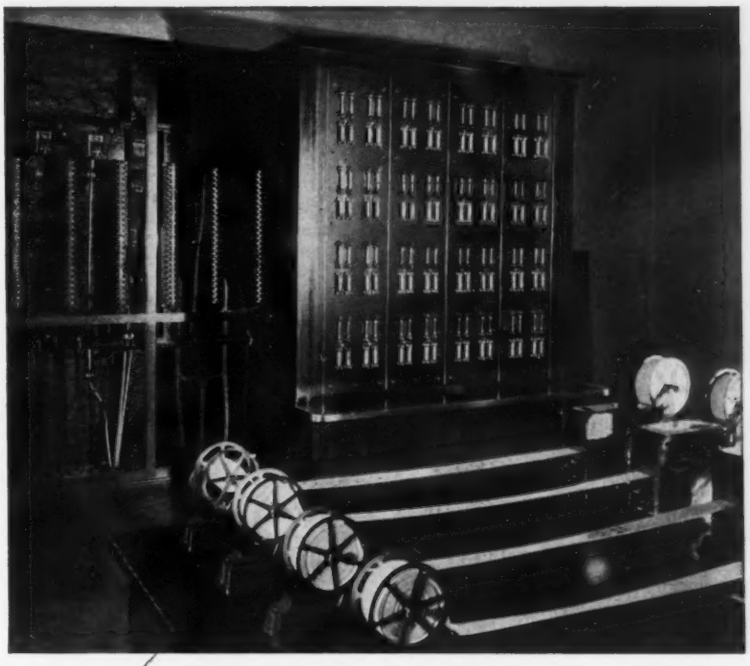
Pressure Switch

Designed for use on domestic water pump, pneumatic and oil systems, to control the starting and stopping of small

No. 611-030 switch; pressure range up to 80 lb. inclusive. **Jefferson Electric Co.**, Bellwood, Ill.

single or polyphase a.c. motors or predetermined pressure settings. Adjustments can be made for various pressure ranges. Differential between "on" and "off" position is usually 20 lb., but may be specified and adjusted for customer's specifications.

You need ACTION when FIRE starts.



Fire Alarm Cables should be selected for their ability to do their job. You need and **must have** action when fire threatens.

Simplex-LATOX Fire Alarm Cables can be depended upon because of the unusually high grade insulation on their conductors.

Simplex-LATOX insulation, containing at least 90% rubber, is thin and yet entirely satisfactory in service.

Simplex-LATOX Fire Alarm Cables can be smaller because dependable performance can be assured without thick, heavy walls of insulation.

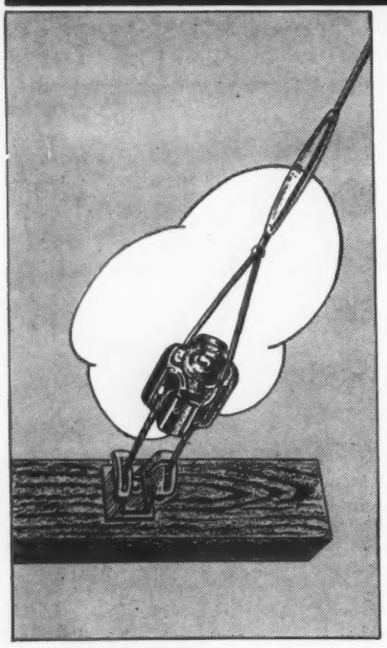
A postcard or letter will bring you a copy of the 28-page booklet "LATOX Lead Covered Cables."

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge, Mass.

Simplex – LATOX

Thin insulation made directly from rubber latex

modernize
YOUR
DISTRIBUTION
PRACTICE—



RELIABLE
STRAIGHTLINE
SPLICE ADAPTER

Reliable double D deadend - adapters permit deadending with a standard splice — easily slipped around a spool or through a strain insulator.

For economy in stocking, and convenience in installation.

Will hold wire to full breaking strength.

Reliable
ELECTRIC COMPANY
OVER 30 YEARS SERVICE TO THE UTILITIES
3143 CARROLL AVENUE • CHICAGO ILLINOIS

TECHNICAL LITERATURE

LIGHTING CAMPAIGNS—Six successful lighting equipment sales campaigns held by different utilities are described in a 90-page manual compiled by the Home Lighting Equipment Sales Committee of the Edison Electric Institute. Copies of the manual "Outline of 6 Home Lighting Equipment Sales Programs," may be obtained from E.E.I., 420 Lexington Ave., New York, N. Y., at 50 cents a copy.

WIRING CALCULATOR—"Handy Calculator" has been brought out by Bull Dog Electric Products Co., 7610 Jos. Campau Ave., Detroit, Mich. One side of the calculator, based on 1940 National Electrical Code, is devoted to wire sizes, capacities and conduit data, with respect to code grade, performance grade and heat-resistant grade wires. On the other side of the scale are shown data for wiring motor circuits.

CONDUIT COATINGS—Results of a two-year investigation into the performance of zinc and enamel protective coatings for rigid steel electrical conduit are given in Bulletin of Research No. 19 of the Underwriters' Laboratories, Inc., 161 Sixth Ave., New York, N. Y. In general, investigation showed superior resistance to corrosion by conduit protected by zinc coatings and a better electrical bond with zinc coatings both before and after exposure to corrosive conditions.

CANADIAN STANDARDS—Canadian Engineering Standards Association, National Research Bldg., Ottawa, Canada, has published a revised edition of Specification C22.2 No. 35—Extra-low Potential Control-Circuit Wires and Cables. Section dealing with insulation has been revised and extended to include rubber insulation, which must be protected by a closely woven cotton braid covered with a flame-proofing compound. Copies may be obtained from C.E.S.A., price 50 cents.

MOTORS—A motor selection chart is included in publication B-6107, "Motors for Driving Power House Auxiliaries", of the Allis-Chalmers Mfg. Co., Milwaukee, Wis. Types and characteristics of this company's line for this application are discussed and illustrated.

FLUORESCENT LIGHTING—Information on fluorescent lamps as a light source and simple rules for layouts for industrial lighting are contained in a four-page Engineering Service Release No. 57, on the subject "Fluorescent Lighting on the Front Line of Defense." The release can be obtained from the Acme Electric & Manufacturing Co., Cuba, N. Y.

FIRE PROTECTION—Brief, concise instructions on how extinguishers should be used on each type of fire is given on a wall sign which is available from Walter Kidde & Co., Bloomfield, N. J. In addition, the poster gives basic fire-fighting facts on carbon dioxide, foam, carbon tetrachloride and water-type extinguishers, tells when each should and should not be used, and describes necessary maintenance required by each unit.

DRIVES — Principles, characteristics, curves, advantages and constructional forms of magnetic drives for boiler draft fans and centrifugal pumps are contained in a new twelve-page publication entitled "Magnetic Variable-Speed Drives." The publication may be obtained from Electric Machinery Mfg. Co., Minneapolis, Minn.

MEETS EVERY DEMAND . . . AT LOWER COST

The all-important tensile strength that steel alone provides . . . the ruggedness to withstand vigorous punishment . . . the ability to outlast normal needs . . . are combined to the highest degree in *Crapo* Galvanized Steel Strand.

Definite economies both in construction and maintenance are made possible by this time-tested product. Its comparatively low initial cost, its workability in the field and its consistently trouble-free performance in service are significant reasons for its selection by engineers for the more important construction jobs.

The extra-durability of *Crapo* Galvanized Steel Strand is directly traceable to its heavy, ductile, tightly-adherent zinc coating, applied by the *Crapo* Process of galvanizing, and to the care and precision of manufacture. Every size and grade of *Crapo* Steel Strand is produced from selected steel, uniformly processed and laboratory tested to insure close adherence to required standards.

Crapo Galvanized Steel Strand is readily available in all standard grades and sizes from representative jobbers throughout the country. Consult the distributor of *Crapo* Galvanized Products near you, or write direct for further information!

INDIANA
STEEL & WIRE CO.
MUNCIE, INDIANA

What Do You Seek in an Insulating Material *besides* Dielectric Strength?

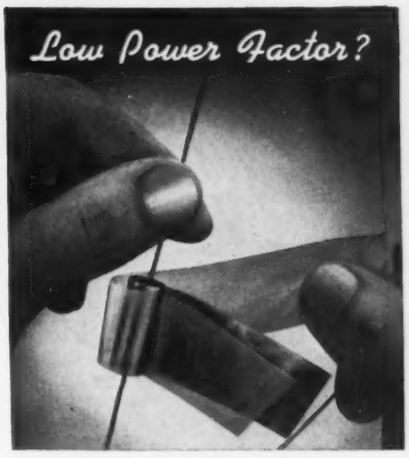
What additional characteristics do you seek in insulating materials besides high dielectric strength? . . . Resistance to impact, vibration or heat? . . . Inertness to oil, moisture or solvents? . . . Flexibility or rigidity? . . . Whatever your requirements, you can obtain the *correct* material to meet any specific service condition from the hundreds of Phenolics, Polystyrenes, Ureas and Acetates at BAKELITE Plastics Headquarters. Available in many forms, including moldable types, sheet stocks, films, and varnishes, this versatile range of dielectrics meets a wide variety of production and maintenance needs.

To assist you in adapting BAKELITE Plastics to your particular needs, Bakelite Corporation gladly offers you the facilities of its Engineering and Laboratory Advisory Service. For complete information on these insulating materials ask for Portfolio 9.

TO WITHSTAND SHOCKS and vibration from powerful spring mechanisms, cams on heavy duty switches that serve as actuating elements between switch handles and contact lever arms are molded from impact-resistant BAKELITE Phenolic Plastics. Izod tests on standard A.S.T.M. notched specimens of various types of these materials show impact readings as high as 1.8 foot-pounds, and even higher on special types.

HANDLES AND FITTINGS for electric irons and other heat-generating devices retain their attractive appearance and heat-insulating value indefinitely when molded from mineral-filled BAKELITE Phenolics. Certain types of these heat-resistant BAKELITE Phenolics will withstand temperatures up to 400°F., though dielectric properties will vary depending upon the material selected.

BAKELITE Heat-Reactive Varnishes are extensively employed as tenacious insulating bonds and protective coatings for coils, armatures and windings. Even when applied in thick layers, they bake evenly throughout to form tough high-dielectric masses that are unaffected by motor heat, oil, moisture, chemical vapors, solvents, and high operating speeds.



THE BAKELITE Polystyrene molding materials so effectively used in high frequency apparatus are now supplemented by BAKELITE Polystyrene Film—another form of insulation made from the same low-loss plastic. Widely accepted for the winding of capacitors, it offers increased efficiency for many other important electronic applications because of its stable characteristics and exceptional resistance to moisture. Available in various widths and thicknesses, BAKELITE Polystyrene Film possesses a power factor of 0.0002 to 0.0003 at 60 to 50,000,000 cycles, and a loss factor of 0.0005 to 0.0008, while its dielectric constant in the same frequency range is 2.50 to 2.60.

BAKELITE CORPORATION, 30 EAST 42ND STREET, NEW YORK, N.Y.

Unit of Union Carbide and Carbon Corporation

UCC

BAKELITE

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PLASTICS HEADQUARTERS

MANUFACTURING - MARKETS

Westinghouse Orders Higher in Quarter

Record bookings in the quarter ended March 31, with new orders totaling $145,620,928, were reported for Westinghouse Electric & Manufacturing Co. by President George H. Bucher at the annual meeting of stockholders in Pittsburgh last week. Mr. Bucher said that in the final quarter of 1940 new orders totaled $138,941,991 and in the first quarter of 1940 the total was $65,250,169.

Unfilled orders on March 31 were $285,000,000, of which 70 per cent are connected with national defense. This compares with $83,000,000 a year ago.

Expansion of plant facilities to handle the increased production needs of both peacetime and defense equipment is "progressing very satisfactorily," Mr. Bucher declared. He said that public utilities have steadily increased their purchases of electric power-making equipment and that orders from power companies for steam turbines and other central station equipment were 24 per cent greater during the past three months than in the first quarter last year.

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Record Orders Shown by General Electric

Orders received by General Electric Co. during the first quarter this year totaled $257,382,000, against $97,490,000 during the same period last year, a gain of 164 per cent, according to President Charles E. Wilson. This was an all-time record amount of new business during a three-month period.

During the first three months this year orders definitely known to cover equipment for national defense purposes amounted to approximately $112,000,000, Mr. Wilson stated. Exclusive of such business, orders for regular commercial products amounted to $145,382,000, or 68 per cent more than for the first quarter of 1940 on a comparable basis.

•

McGraw Electric Net Sales in Sharp Gain

McGraw Electric Co., with net sales running almost double those of a year ago, closed the first quarter of its 1941 fiscal year with gross earnings probably at a record high for any similar January-March quarter in the company's history.

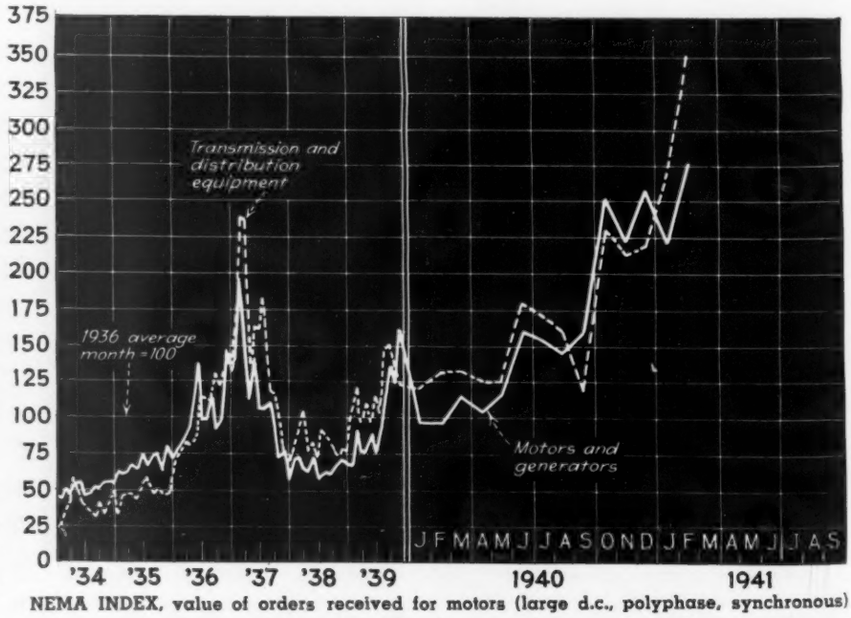
Net profit, however, will not completely reflect the sales gain over last year because of higher tax rates. Profit margins in the appliance field, too, are tending to narrow slightly with increases in raw material costs. Construction of an addition to the McGraw plant at Elgin which will add about 65,000 sq.ft. to floor space will begin shortly.

Electrical Orders Hit February Peak

The index of orders received for motors and generators during February rose 25 per cent over the preceding month and reached a new high of 275.7 in the index reported by the National Electrical Manufacturers Association. Last year there was a rise of only 0.6 per cent in February over January, and the year before there was a decrease of 2 per cent.

The index of orders received for transmission and distribution equipment for February rose 81.9 points to a new high of 350.9, an increase of 30.4 per cent over January. Last year the rise was 8.5 per cent and the year before 33.5 per cent.

N.E.M.A. reported that the index of value of sales billed for the month rose 3.8 per cent over January, a new high for this index, and contra-seasonal as compared with the preceding three years.



NEMA INDEX, value of orders received for motors (large d.c., polyphase, synchronous) and generators (engine, belt-driven); also for transmission and distribution equipment

Manufacturers Make Sales Assignments

Lincoln Electric Co., Cleveland, Ohio, announces the appointment of Stewart J. Hieronymus as sales engineer with its San Francisco office. Prior to his appointment Mr. Hieronymus was associated with Cutler-Hammer, Inc., for twelve years.

Among the other appointments recently announced are the following:

N. M. Mintz & Associates, Chicago, Ill., have been appointed sales engineering representatives in the Chicago area for Pennsylvania Transformer Co., Pittsburgh.

U. S. Rubber Co. announces the appointment of J. C. Bird as sales representative for its electrical wire and cable division in the Seattle district. Mr. Bird's organization will be known as Electric Agencies and will be located at 2207 First Avenue South, Seattle, Wash.

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Revere Orders Indicate 1941 Will Surpass '40

Despite a shortage of copper, the establishment of priorities is not an answer to the problem of the copper fabricating industry, C. Donald Dallas, president of Revere Copper & Brass, Inc., said at the recent annual meeting of stockholders. "The solution to avoiding an unnecessary increase in the price and also insuring a supply can be accomplished by getting rid of the excise tax of 4 cents," he said.

Regarding prospects for 1941, he said all the company's plants are now operating virtually at full capacity, and that from orders on the books, provided sufficient raw materials are available, production should outstrip that of 1940.

•

Higher Income Indicated

At the annual meeting of stockholders of Stewart-Warner Corp., James S. Knowlson, president and board chairman, stated that "although final figures for the first quarter of 1941 are not yet available, they should show an improvement over the corresponding 1940 period. Uncertainty, however, of general conditions and taxes makes any prediction as to the future a matter of guessing."

New York Metal Prices

	April 15, '41 Cents per Pound	April 9, '41 Cents per Pound
Copper, electrolytic	12.00*	12.00*
Lead, A. S. & R. Price	5.85	5.85
Antimony	14.00	14.00
Nickel, Ingot	35.00	35.00
Zinc Spots	7.64	7.64
Tin, Straits	52.00	51.625
Aluminum, 99 per cent	17.00	17.00

*Delivery Connecticut Valley.

Field Reports on Business

Shipments of electrical equipment are expected to take a sharp jump as a result of speeding of production lines. Backlogs continue to swell. Strikes have slowed output and wage increases foreshadow higher prices. Utilities and industrials are buying a variety of electrical machinery and equipment.

NEW YORK

A greater degree of government regulation of prices and supply of material is seen by industrial leaders as a higher rate of production for defense is being asked. Likelihood is that consumer production will be sacrificed for defense and priorities will become more important. Indications are that those companies allowing the price spiral to move too rapidly will be denied sources of materials for production.

The National Association of Manufacturers has made seven recommendations to prevent hoarding of strategic defense materials. Main objective is to prevent ordering too far in advance of anticipated production needs. Recourse to substitutes is also recommended. Surplus supplies may be thrown into a pool from which all may draw.

Price advances are being noted in small electrical appliances. A second advance has been made in refrigerators by General Electric. Others are likely to follow. Demand for household appliances continues on the upswing, with utilities and dealers still driving hard further to increase sales. The increase in purchasing power has broadened most markets.

Navy contracts call for $1,833,385 of electric cable to three companies. Utilities continue active in the market for transformers, condensers and a variety of other equipment.

Engineering construction awards last week were 174 per cent higher than a year ago and 102 per cent above the preceding week. Private construction is up almost double that of a year ago. Rochester Gas & Electric has let contract for a $3,560,000 steam-generating plant and $635,135 transmission line. The number of new housing developments is increasing.

PACIFIC COAST

The value of building permits in the seven Western states during March this year increased 44 per cent over that of last year, though recording a slight decrease below February, all in Washington. Six California cities, besides Seattle, Portland and Boise, exceeded the million mark during March.

Lighting business features such typical installations as flying field and ground lighting, boundary lighting for government radio stations, scattered street lighting systems, mainly for interior cities, and plant floodlights. One order consisted of 35,000 40-watt Westinghouse fluorescent lamps for a Lockheed subsidiary at Burbank. The Bank of America's San Francisco headquarters building will install 2,000 25-watt "Sterilamps" for air conditioning. Adequate wiring certificates for new homes on Pacific Gas & Electric system register 47 per cent increase over first quarter of 1940.

Recent orders of varied interest include four 1,500-kva. Pyranol transformers, value $52,000, for Bethlehem Steel, San Francisco; $23,000 of 200-hp. motors for a Nevada copper mine; $40,000 fractional-hp. motors for calculating machines; nineteen 200-hp. motors, value $55,000, for a Utah mine, and $70,000 switchgear equipment for Pearl Harbor installation. Carrier current installations are being made for sectors of Pacific Gas & Electric and the Bonneville systems, also for Elephant Butte and Parker projects. Bonneville purchasing includes $48,000 of 115- and 196-kv. insulators, $17,500 wood poles, four 4,000-kva. Allis-Chalmers transformers, value $40,902, and $40,614 copper wire for its Longview sector. Shasta Dam is buying $100,000 thin wall tubing and $120,000 1-in. black pipe. The Reclamation Bureau is requesting $41,000,000 for Bulls Head Dam and plant to assist Boulder storage and regulation, with $5,000,000 as an initial appropriation.

NEW ENGLAND

Industrial activity in this district continues at record peaks due to orders for armament from foreign countries and to demands of our own preparedness program. Large backlogs accumulated during the past four months are being constantly augmented by a steady succession of orders for diversified electrical equipment. Machine tool builders are buying small motors at a good rate; a manufacturer of high-voltage switches and circuit breakers reports heavy bookings from the U. S. government; arc-welder units are in demand and deliveries are becoming more and more difficult to guarantee. Substantial increases in employment throughout this district presage further construction of housing units and promise activity in both electrical supplies and appliances.

A commercial electric cooking show held last week by Hartford Electric Light Co. was attended by 400 food industry representatives. Thirty-five exhibitors participated.

Insulators for an 11-mile, 110-kv. transmission line in this area have been bought. Westinghouse has booked an $11,684 furnace contract and Stanley P. Rockwell & Co., Inc., has been awarded a furnace order amounting to $3,525. U. S. Navy has awarded a $12,000 order for G.E. exposure meters and a Massachusetts manufacturer has installed a 55-kw. infra-red oven.

CHICAGO

Effects of the vast spending for defense work is becoming more pronounced as direct orders and an increased number of sub-contracts are being spread over a broader area. With industrial plant expansion continuing at a rapid pace and railroads buying in large volume, sizable orders for electrical equipment are being placed.

Bids were requested last week on 800 residential fixtures and 100 instrument current transformers by the city electrical department. Electrical permits issued are steadily increasing in number and show considerable activity installing motors, transformers, control equipment, additional outlets and lighting fixtures.

Of 27 manufacturers reporting March sales to the Electric Association, 20 show an increase over February, while 25 had gains over March, 1940. Building construction in this area was the most active of any March since 1931.

Defense orders placed here last week for electric equipment included: Generators, $33,790; wire and cable, $32,451; electric trucks, $49,125; cookers, $18,260; transformers, $12,481.

A.E.C. — A.I.E.E. — A.S.M.E. — A.I.S.E. — E.E.I. — I.E.S. — N.E.C.A. — N.E.M.A. — N.E.W.A. — P.E.A. — I.R.E. — A.C.M.A. — A.S.A.E. — A.S.T.M. — A.S.H.V.E. — A.S.A. — A.W.S. — C.E.A. — E.S. — I.A.E.L. — N.D.H.A. — N.F.P.A. — N.E.L.P.A. — P.U.A.A. — R.M.E.L. — S.E.E. — V.C.M.A. — I.A.E.I. — A.W.I.M.A. — N.A.P.A. — C.C.P.S.I. — I.S.P.U.A. — I.E.A. — I.P.U.A. — L.E.S. — M.U.A. — M.E.L.A. — N.C.E.A. — M.A.P.U. — M.V.E.A. — N.J.P.U.I.C. — E.S.G.E.A. — O.U.A. — P.U.A.V. — V.E.A. — P.U.A.W.V. — W.U.A. — A.U.A. — P.C.E.A. — I.P.C.E.A. — N.B.F.U. — N.S.C. — W.S.E. — A. P. I. — A.S.C.E. — A.S.R.E. — A.T.E.A. — A.A.R. — A.E.C. — A.I.E.E. — A.S.M.E. — A.I.S.E. — E.E.I. — I.E.S. — N.E.C.A. — N.E.M.A. — N.E.W.A. — P.E.A. — I.R.E. — A.C.M.A. — A.S.A.E. — A.S.T.M. — A.S.A. — A.S.H.V.E. — A.W.S. — C.E.A. — E.S. — I.A.E.L. — N.D.H.A. — N.F.P.A. — N.E.L.P.A. — P.U.A.A. — R.M.E.L. — S.E.E. — V.M.C.A. — I.A.E.I. — A.W.I.M.A. — N.A.P.A. — C.C.P.S.I. — I.S.P.U.A. — I.E.A. — I.P.U.A. — L.E.S. — M.U.A. — M.E.L.A. — N.C.E.A. — M.A.P.U. — M.V.E.A. — E.S.G.E.A. — N.J.P.U.I.C. — O.U.A. — P.C.E.A. — I.P.C.E.A. — N.B.F.U. — N.S.C. — W.S.E. — A.P.I. — A.S.C.E. — A.S.R.E. — A.T.E.A. — A.A.R. — A.E.C. — A.I.E.E. — A.S.M.E. — A.I.S.E. — E.E.I. — I.E.S. — N.E.C.A. — N.E.M.A. — N.E.W.A. — P.E.A. — I.R.E. — A.C.M.A. — A.S.A.E. — A.S.T.M. — A.S.A. — A.W.S. — C.E.A. — E.S. — I.A.E.L. — N.D.H.A. — N.F.P.A. — N.E.L.P.A. — P.U.A.A. — R.M.E.L. — S.E.E. — V.C.M.A. — I.A.E.I. — A.W.I.M.A. — N.A.P.A. — C.C.P.S.I. — I.S.P.U.A. — I.E.A. — I.P.U.A. — L.E.S. — M.U.A. — M.E.L.A. — N.C.E.A. — M.A.P.U. — M.V.E.A. — N.J.P.U.I.C. — E.S.G.E.A. — O.U.A. — P.U.A.V. — V.E.A. — P.U.A.W.V. — W.U.A. — A.U.A. — P.C.E.A. — I.P.C.E.A. — N.B.F.U. —

ANNOU

N.S.C. — W.S.E. — A.P.I. — A.S.C.E. — A.S.R.E. — A.T.E.A.

UNCING

THE THEME OF THE MAY 31st ISSUE OF
ELECTRICAL WORLD

"Association for Service"

An exposition of the benefits that have accrued through the cooperative efforts of electrical men in industry associations

NEWS ABOUT PEOPLE

Railway and Industrial Engineering Promotions

Promotion of Kirkwood S. Nevin to general manager of the Railway & Industrial Engineering Co., Greensburg, Pa., has been announced by B. W. Kerr, president. Sales department changes include the election of Wilbert M. McCauley as commercial vice-president and George L. Carlisle as manager of sales. A new office of director of materials has been filled by Howard Livezey. Mr. Livezey will have charge of purchases, storerooms and all record and requisition activity in connection with materials.

G. L. Carlisle W. M. McCauley K. S. Nevin

Mr. Nevin has spent practically his entire business career with Railway & Industrial Engineering Co., joining it in 1916 as a clerk. In 1922 he was elected treasurer and to a place on the board of directors. In 1926 he became secretary and treasurer. Mr. Nevin is also president of Eastern Power Devices, Ltd., Toronto, Ont., a company affiliate.

After attending Lehigh University, Mr. McCauley joined the company in 1915 as a draftsman. After the World War he became manager of the Pittsburgh district sales office, remaining in that position until 1929, when he returned to Greensburg as manager of sales. He is vice-president of Eastern Power Devices, Ltd., of Toronto.

Following graduation from Ohio Northern University in 1912 as an electrical engineer, Mr. Carlisle spent seven years in the design, construction and operation of coal mines both in a consulting capacity and as operating superintendent of plants and equipment. He then entered the employ of West Penn Power Co., where he worked on substation design and construction. He resigned to become factory manager of Champion Switch Co., later becoming vice-president and general manager. In 1932 he joined Railway & Industrial Engineering Co. as manager of the distribution department, the position he held until his recent promotion.

Mr. Livezey was connected with the Electrical Development & Machine Co. when in 1926 it was consolidated with Railway & Industrial Engineering Co. Mr. Livezey was transferred to Greensburg as purchasing agent.

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► E. Bosworth Grier, secretary of Arrow-Hart & Hegeman Electric Co., in charge of patents, licenses and contracts, has been elected to the directorate to fill the vacancy resulting from the recent death of his father, Edward R. Grier. Mr. Grier entered the company's employ in 1918 and has been secretary since 1930, with offices at the Hartford, Conn., plant.

E. C. Eicher Takes Office As Chairman of S.E.C.

Edward C. Eicher, who was recently elected chairman of the Securities and Exchange Commission, has demonstrated a special interest in administration of the Public Utility Holding Company Act. He was a member of the 73d, 74th and 75th Congresses, but resigned his seat in 1938 to accept appointment by President Roosevelt as a member of the commission, filling the unexpired term of John Hanes. He was then reappointed for a term expiring June 5, 1945.

While in Congress, Mr. Eicher was an ardent defender of the Public Utility Holding Company Act and served as a member of the subcommittee which drafted the legislation in 1935. He was one of the first SEC members openly to advocate competitive bidding for utility securities, which has just been made mandatory by the SEC.

A native of Iowa and a graduate of the University of Chicago, Mr. Eicher studied law and was admitted to the Iowa bar in 1906. From 1907 to 1909 he was assistant registrar of the University of Chicago and for the next nine years assistant general attorney of the Iowa district of the Chicago, Burlington & Quincy Railroad. He resigned in 1918 to become a member of the law firm of Eicher, Livingston & Eicher in Washington, Iowa. In 1932 he was elected to Congress.

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► J. O. R. Coleman has resigned from the Edison Electric Institute, where he was an engineer, to join the Stone & Webster Engineering Corp. Mr. Coleman was graduated from the University of Virginia in 1921 as an electrical engineer and from the Massachusetts Institute of Technology in 1923 with the degree of master of science. He has been employed by the New York Edison Co., now the Consolidated Edison Co.; Philadelphia Electric Co., and

DID YOU HEAR THIS IS THE BIGGEST UTILITY POWER PLANT CONSTRUCTION YEAR IN A DECADE .....

..THAT'S ASSURING

.....AND MORE INSTALLATIONS OF **ORANGEBURG** FIBRE CONDUIT....

....THAT'S INSURING

"INSURING"

. . . because Orangeburg insures complete and permanent cable protection.

Complete cable protection because corrosive underground water cannot penetrate Orangeburg's walls or joints and reach the cable sheath. Permanent cable protection because being essentially hard coal-tar pitch, Orangeburg is essentially everlasting.

Whatever your conditions—under heavy boulevard traffic, corrosive cinder and refuse back fill, or acid-soaked factory yard—there's an Orangeburg Conduit to meet them, effectively and economically.

Sales Agent—Distributors

Graybar Electric Company Inc.

General Electric Supply Corp.

Build for tomorrow with

ORANGEBURG Conduits

MADE AT ORANGEBURG, NEW YORK, BY THE FIBRE CONDUIT COMPANY, 292 MADISON AVE., NEW YORK CITY

ORANGEBURG NOCRETE for installation without concrete encasement

STANDARD for installation with concrete encasement

DILLON TRACTION DYNAMOMETER

SCIENTIFIC TENSION MEASURING INSTRUMENT

For accurately determining the pound pull on power, transmission, cable, messenger, and guy strand wires.

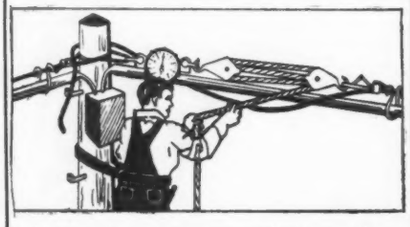


Illustration shows practical application of this approved method of securing the proper tension of a messenger, when installed, through the use of a DILLON DYNAMOMETER.

10 different capacities ranging from
0-500 lbs. $50.00
to
0-15,000 lbs. $117.50
Including shackles and carrying case

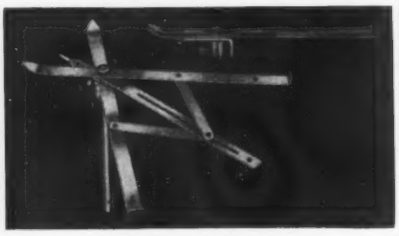
DILLON TEMPEROMETER

A testing instrument embracing utility, stability and accuracy. For all purposes. Instant reading.

Registers Correct Temperatures of Paraffin, Compounds, Wiping Solder, Impregnation Wax, Cable Damming Waxes. Calibrated from 150 to 1000 degrees F. Fully guaranteed.

$6.00 each

DILLON BISECTOR



NEW — VALUABLE

For Construction Engineers, Surveyors, Superintendents, and Line Crews. Quickly locates accurate anchor location. No charts, tape or mathematics. Takes one man less than a minute. **Price $4.00**

W. C. DILLON & CO., INC.
5410 W. Harrison, St. Chicago, Ill.

since 1926 he has been connected with the National Electric Light Association and the Edison Electric Institute.

•

Carolina Utility Elects Crist Vice-President

At the recent annual meeting of the South Carolina Power Co., Charleston, S. C., James F. Crist, commercial manager, was elected a vice-president.

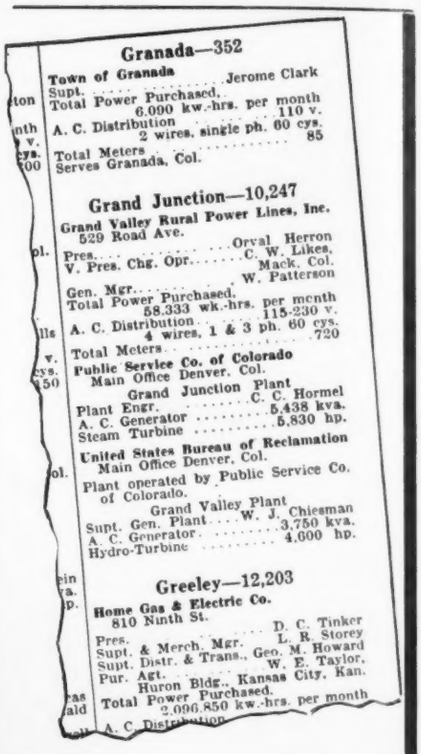
A native of Montgomery, Ala., Mr. Crist is a graduate of Virginia Military Institute and the Massachusetts Institute of Technology, and also attended Harvard University. He was Pacific Coast representative for J. J. Grover's Sons Co. of Lynn, Mass., until the fall

of 1925, and was associated with Brown & Crist in the real estate and insurance business in Sarasota, Fla., until 1927, when he entered the employ of the Alabama Power Co. in the power sales department.

He went to Charleston in 1929 as power sales and rate engineer for the South Carolina Power Co.; in 1931 was made manager of power sales and commercial manager in 1939. He became president of the Charleston Shipbuilding & Drydock Co. in 1937, resigned the following year and remained a director of the company until recently.

•

▶ WILLIAM B. FARNSWORTH has been promoted to the position of merchandise manager of the Georgia Power Co. The appointment was announced by O. M. Jackson, who had continued to serve as merchandise manager since he was promoted to the position of sales promotion manager. Mr. Farnsworth had served as assistant merchandise manager since 1934. He joined the company sales department in 1925 after graduation from Georgia Tech. He has served successively as



Granada—352
Town of Granada ..... Jerome Clark
Supt. .....
Total Power Purchased, 6,000 kw.-hrs. per month
A. C. Distribution ..... 110 v.
2 wires, single ph. 60 cys.
Total Meters 85
Serves Granada, Col.

Grand Junction—10,247
Grand Valley Rural Power Lines, Inc.
529 Road Ave.
Pres. ..... Orval Herron
V. Pres. Chg. Opr. ..... C. W. Likes,
Mack, Col.
Gen. Mgr. ..... W. Patterson
Total Power Purchased, 58,333 wk.-hrs. per month
A. C. Distribution ..... 115-230 v.
4 wires, 1 & 3 ph. 60 cys.
Total Meters 720
Public Service Co. of Colorado
Main Office Denver, Col.
Grand Junction Plant
Plant Engr. ..... C. C. Hormel
A. C. Generator ..... 5,438 kva.
Steam Turbine ..... 5,830 hp.
United States Bureau of Reclamation
Main Office Denver, Col.
Plant operated by Public Service Co. of Colorado.
Grand Valley Plant
Supt. Gen. Plant ..... W. J. Chiesman
A. C. Generator ..... 3,750 kva.
Hydro-Turbine ..... 4,600 hp.

Greeley—12,203
Home Gas & Electric Co.
810 Ninth St.
Pres. ..... D. C. Tinker
Supt. & Merch. Mgr. ..... L. R. Storey
Supt. Distr. & Trans., Geo. M. Howard
Pur. Agt. ..... W. E. Taylor,
Huron Bldg., Kansas City, Kan.
Total Power Purchased, 2,096,850 kw.-hrs. per month
A. C. Distribution

THIS just gives you a quick idea of the completeness of the listings in the 1940 Central Station Directory. Check it over and see what **more** information you could want to make up market analyses . . . to help salesmen or representatives see the **right** person . . . or for quick reference for that particular bit of information you need. The Central Station Directory is a veritable encyclopedia, one that will save you dollars, cents and time.

●

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Gentlemen: You may mail us ..... copies of the 1940 McGRAW CENTRAL STATION DIRECTORY. Deliver to the following address and bill us at the rate of $25.00 per copy. (10% discount on 5 or more copies.

(Company) .....
(Address) .....
.....
(Signed) .....
NAME TITLE

buyer in the purchasing department, assistant district office manager, aid to the assistant merchandise manager and as assistant sales manager of the Macon properties. In 1929 he was appointed as Augusta division sales supervisor. Two years later he was transferred to Rome as division sales supervisor, where he served until his appointment as assistant merchandise manager.

▶ HAROLD B. DONLEY, manager of the appliance department, merchandising division of the Westinghouse Electric & Manufacturing Co. at Mansfield, Ohio, has been appointed merchandise sales manager of the Westinghouse Electric Supply Co. with headquarters in New York City.

▶ H. P. J. STEINMETZ, vice-president Public Service Electric & Gas Co., Newark, N. J., was elected chairman of the National Better Light-Better Sight Bureau at a recent meeting of the bureau's executive committee. Mr. Steinmetz will serve as chairman during 1941 and 1942. In charge of all sales and promotional work for his company, Mr. Steinmetz is also a past-chairman of the general sales committee of the Edison Electric Institute. He has long been deeply interested in lighting promotion.

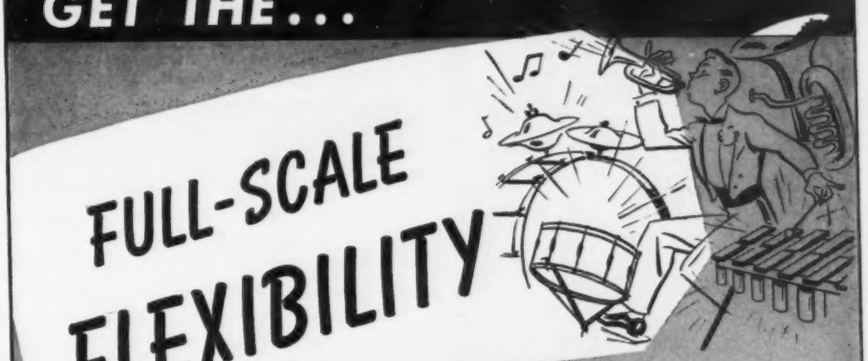
▶ DR. NORMAN R. GIBSON, a vice-president of Niagara Hudson Power Corp., was elected a director of the corporation at the recent annual meeting of stockholders. He is chief engineer of the Niagara Hudson companies. Dr. Gibson has been associated with the electric power industry since 1904 and his continuous service with the system companies extends over a period of 23 years.

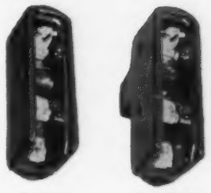
▶ F. E. (ED) ROSS, refrigeration advertising manager for the Westinghouse merchandising division, has been called to a year's active duty at the U. S. Army infantry school at Fort Benning, Georgia. A captain in the infantry reserve, he will serve as an instructor on the faculty of the infantry school. Mr. Ross has been given a one-year leave of absence. J. R. CLEMENS, who has been in charge of range and water heater advertising, will take over Mr. Ross's work.

▶ J. J. CURTIN, who for the past eleven years has been in charge of sales promotion and publicity work in the motor division of the industrial department of the General Electric Co., has been transferred to the wire and cable division of the central station department at Fort Wayne, Ind. He is in charge of magnet wire sales, replacing B. F. ILSLEY, who moved to Schenectady to

GET THE...

FULL-SCALE FLEXIBILITY OF G-E FUSE CUTOUTS via GraybaR



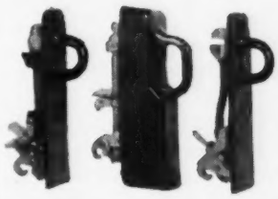


5 K.V. 7.5 K.V.

THESE 2 HOUSINGS...

are the starting points for the highly flexible system developed by *General Electric* to fill all your distribution fuse cutout requirements. The two housings in each current rating (50 amps., 100 amps.) will take indicating and drop-out doors, disconnecting doors, or two-element reclosing doors — interchangeably.

Plus



THESE 3 DOORS...

make the flexibility complete. Each door will fit both housings (5kv and 7.5kv) in the same current rating. It's just a few minutes' job, too, to switch from one type of door to another should the need arise. You can stock fewer parts, make fewer replacements, yet always keep the right equipment on the line.

This *General Electric* line of enclosed indicating and drop-out fuse cutouts is saving money on distribution systems, coast to coast. More than 500,000 have gone into service since 1935.

Yet this is just one of the popular power distribution items that GRAYBAR makes it a point to have conveniently available to meet your needs. One call to GRAYBAR brings performance-tested products from "the top of the pole to the bottom of the hole" —all stand-out lines from leading suppliers. Next time you buy, make it "via GRAYBAR."

FREE 20-PAGE BULLETIN

"G-3448" gives complete specifications, performance features and prices for G-E Fuse Cutouts, fuse links and accessories. Write GRAYBAR for your copy.

GraybaR In Over 80 Principal Cities

GRAYBAR ELECTRIC COMPANY
Executive Offices:
Graybar Building, New York, N.Y.

GraybaR QUALITY

Distributed and guaranteed by GraybaR ELECTRIC COMPANY

DEFENSE
Against Possible
COPPER WIRE SHORTAGE

And a $244 Saving on
SCRAP WIRE
Splicing with a
KEARNEY
No. 6 ABC MACHINE
and modern, clean-bore
SPLICING SLEEVES

ONE company saw possibilities of a shortage in copper wire. But there was 2800 pounds of No. 6 wire on the scrap heap — and, an on-and-off lineman in the storeroom.

The lineman went to work on that scrap heap with a No. 6 Kearney ABC Sleeve Rolling Machine—used 388 splicing sleeves —spent 60 hours on the job. After deducting time and materials costs from the value of the wire saved, the books showed $244.00 profit—plus 2800 pounds of wire available for emergencies.

So, any company might prepare against copper wire shortage and get profits from the scrap heap . . . Worth investigating, isn't it? Write today — **James R. Kearney Corporation, 4236 Clayton Ave., St. Louis, Mo., — *Canadian Plant,* Toronto, Canada.**

JAMES R. KEARNEY
The Mark of Quality Products
UTILITY EQUIPMENT
for BETTER Construction

be general assistant to W. V. O'Brien, division manager of wire and cable. O. F. VEA has taken over the work formerly handled by Mr. Curtin. P. A. MCTERNEY has been appointed manager of sales, large motor and generator division of the industrial department. An apparatus agency sales section has been added to the industrial department under the supervision of G. L. IRVINE, who has been appointed manager of apparatus agency sales. G. E. CASSIDY has been appointed engineer of the general applications section, a new division of the industrial engineering department. J. S. OVERSTREET has been placed in charge of wire and cable sales, G. E. wire and cable division, Schenectady.

▶ JOHN D. BIGGS of Greenville, County Judge of Bond County, has been appointed by Gov. Dwight H. Green as chairman of the Illinois Commerce Commission. He will fill the post formerly occupied by Major-Gen. Roy D. Keehn, resigned. Judge Biggs is regarded by the legal profession as a high authority on statutory law.

▶ MAJOR-GEN. ROY D. KEEHN of Chicago has resigned as chairman of the Illinois Commerce Commission to become a member of the State Athletic Commission. General Keehn has been active in public affairs in Illinois for many years. He was appointed chairman of the Commerce Commission in 1940, filling the vacancy caused by the resignation of James M. Slattery when he was appointed United States Senator.

▶ A. E. DYMENT has retired as chairman of the board of directors of the Canadian General Electric Co., Ltd., Toronto. D. C. DURLAND, president of the company, assumes the additional position of board chairman. Mr. Dyment retained his position as a director. STEPHEN HASS retired as vice-president, remaining on the board. Widely known in business circles throughout Canada, Mr. Dyment was first elected to the board in 1907, and has served as vice-president of the company, president and chairman of the board.

▶ MALCOLM G. DAVIS has been elected vice-president of the Atlantic Utility Service Corp., service company for the Associated Gas & Electric System, in charge of the recently formed rate and rate research department. Mr. Davis is a graduate of the Massachusetts Institute of Technology and has been affiliated with the Southern Sierras Power Co., California Railroad Commission, Philadelphia Co. as supervisor of cost analysis and later director of rates and statistics, and has also engaged in consulting practice with the American Appraisal Co. and with Peter F. Loftus, consulting engineer.

OBITUARY

Andrew Patterson

Andrew Patterson, chief engineer of the Southwestern Gas & Electric Co. since 1925, died April 4 at his home in Texarkana, Tex., in his sixtieth year. Mr. Patterson had been a resident of Texarkana for the past 28 years, going to that city in 1914 from Ft. Smith, Ark., where he had served as superintendent of a utility company. He joined the Dawes Electric Co. as superintendent on his arrival in Texarkana, serving in this capacity until that company was taken over in 1925 by the newly organized Southwestern company. Mr. Patterson was then made chief engineer of the entire Southwestern Gas & Electric Co., the position he held until his death.

A native of Baltimore, Md., Mr. Patterson was educated in Baltimore public schools and at the Baltimore Polytechnic Institute. He was a member of the American Institute of Electrical Engineers.

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▶ JOHN I. MISENER, president and founder of Misener Manufacturing Co., Inc., Syracuse, N. Y., manufacturer of electric portable drills, died on February 8.

▶ THOMAS W. FITZGERALD, head of the electrical engineering department of the Georgia Institute of Technology, Atlanta, died in a hospital in that city on February 20, after an illness of more than a month. He was 55 years of age. Before joining the teaching staff of Georgia Tech in 1920, Professor Fitzgerald was connected with the Ray Consolidated Copper Co. and previous to that connection he had been associated with the staff of Michigan State College and with the University of Arizona.

▶ PROF. MILES WALKER, British electrical engineer, died on January 22 at the age of 73, following an operation. He was well known for his original work on the design of electrical machinery. Born in Carlisle, Professor Walker practiced law in London before entering the engineering field, which had always been his preference. He obtained his technical education at Finsbury Technical College and at Cambridge. In the late '90s the Westinghouse Electric & Manufacturing Co., which was making plans to start works in England, asked Sir Alfred Ewing, who was then professor of engineering at Cambridge, to nominate a number of men to come to the United States in order to study its methods. Mr. Walker was one of those selected and he spent

more than three years in the shops of the company at Pittsburgh. On his return to England he was appointed designer of alternating-current machinery to the British Westinghouse Co., now the Metropolitan-Vickers Electrical Co., at its Trafford Park Works. While holding this position he was responsible for a number of improvements in the construction of electrical rotary machinery. He also invented the Walker self-reglating alternator and an electric harmonic analyzer. Later he served on the teaching staff of the Imperial College of Science, London, and in 1912 he was appointed professor of electrical engineering at the University of Manchester, the position he held until 1932, when he retired with the rank of emeritus professor. Professor Walker was the author of several text-books and of a number of technical papers and was active in the affairs of the Institution of Electrical Engineers.

▶W. W. McLaren, manager of the commercial sales department of the Birmingham Electric Co. since 1936, died April 3, at his home in Birmingham. He had been connected with the company for 34 years.

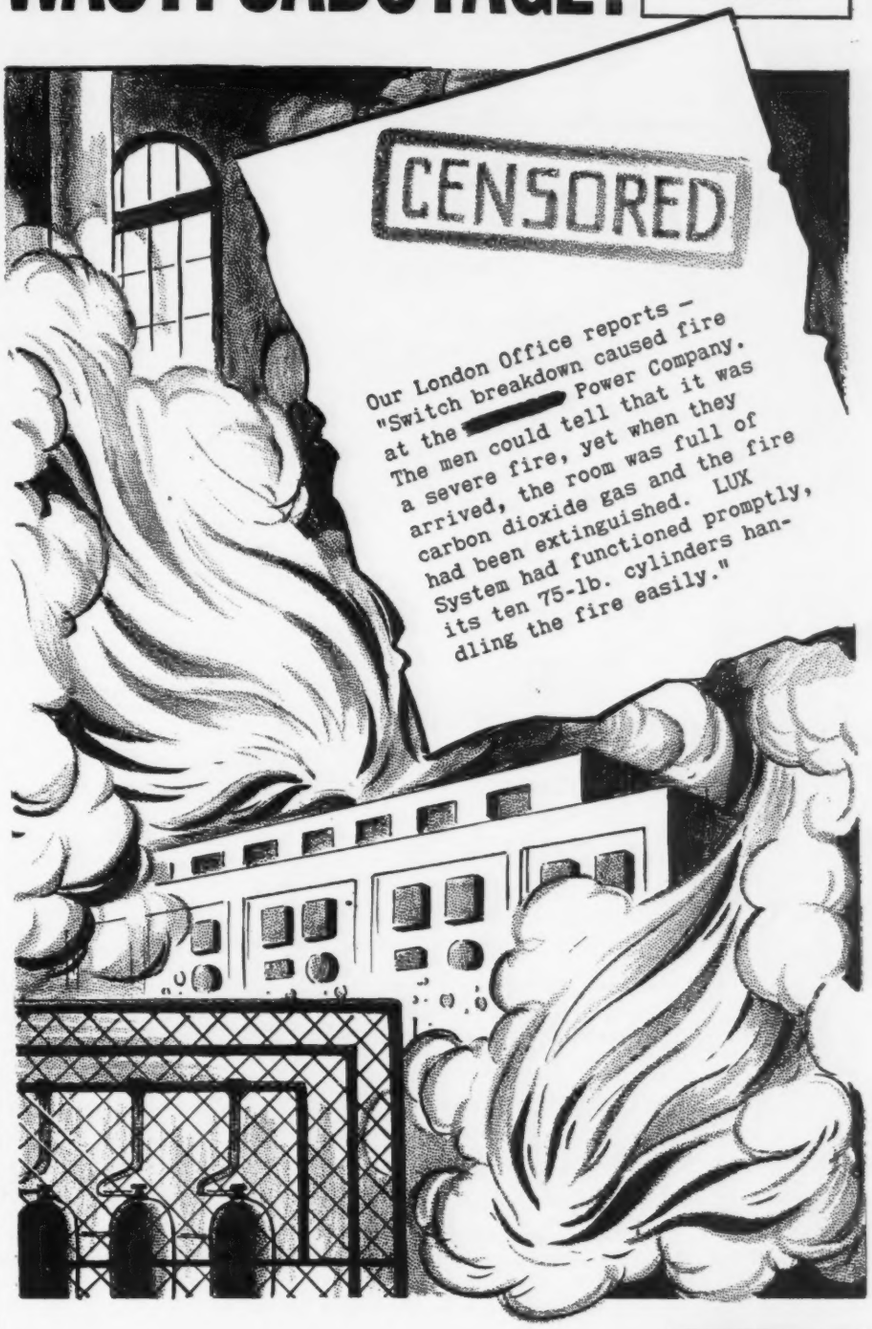
▶Henry R. Mayo, 62, a director of the Lynn (Mass.) Gas & Electric Co., and widely known in public utility legal circles in Massachusetts, died at the Massachusetts General Hospital in Boston on March 4. He was a former president of the Massachusetts Bar Association.

▶Treffly C. Capistron, 47, superintendent of the southern district of the New England Power Association and of production for the Narragansett Electric Co., Providence, R. I., died April 6, of a heart attack, suffered two days before at his office in Providence. He was a native of Millbury, Mass., and had been connected with the New England Power system for 25 years. Before going to Rhode Island in 1935 he was superintendent of the central division of the New England Power group, with headquarters at Worcester, Mass., and was widely known as an operating man in northeastern utility circles.

▶Joseph R. Ensign, 73, chairman of the Ensign-Bickford Co., Simsbury, Conn., died at his home in that place on January 22. He was educated at Yale University and entered the fuse company in 1890, becoming vice-president in 1907 when the organization was incorporated, president in 1917 and chairman in 1935. He was one of the incorporators of the Simsbury Electric Co., and besides being a director in many Connecticut enterprises was active in historical and philanthropic affairs.

WAS IT SABOTAGE?

A REPORT FROM ENGLAND


CENSORED
Our London Office reports —
"Switch breakdown caused fire
at the [redacted] Power Company.
The men could tell that it was
a severe fire, yet when they
arrived, the room was full of
carbon dioxide gas and the fire
had been extinguished. LUX
System had functioned promptly,
its ten 75-lb. cylinders han-
dling the fire easily."

We, in America, may also have sabotage. Are you ready for it?

Have you automatic fire protection for vital equipment? LUX Built-in Systems deliver their fire-killing charge of carbon dioxide the instant that trouble appears. Generators, oil switches, transformers, frequency changers—all of these are safer with the sure-handed, fast action of LUX fixed extinguishing systems.

Be prepared for fire — no matter how it starts ... no matter where it strikes! Get built-in LUX protection.

LUX

Walter Kidde & Company
INCORPORATED
428 West Street, Bloomfield, N. J.

ASPLUNDH

THIS IS WHERE YOU GET PERPETUAL FREEDOM FROM POWER LINE FAILURE DUE TO TREES

—BRANCH OFFICES—

CHICAGO, ILLINOIS
Randolph 7773
BINGHAMTON, N. Y.
Binghamton 4-5314
COLUMBUS, OHIO
Adams 5432
WASHINGTON, D. C.
Shepherd 5249
BALTIMORE, MD.
Glenburnie 790 J
ALEXANDRIA, VA.
Alexandria 3581
PITTSBURGH, PA.
Atlantic 9798
NEW CASTLE, PA.
New Castle 2285
RUTHERFORD, N. J.
Rutherford 2-7434
CAMBRIDGE, MASS.
Kirkland 5330
DURHAM, N. C.
Durham X-5503

TREE EXPERT COMPANY
JENKINTOWN, PENNSYLVANIA
OGONTZ 3750

Line Clearance Exclusively

Rural Construction Contracts Awarded

Among the REA construction contracts approved between February 10 and March 22 are the following:

ARKANSAS—Ozarks Rural Electric Co-operative Corp., Fayetteville, E. H. Looney, supt., and Ray W. Chanaberry, Inc., 1000 Realty Bldg., Louisville, Ky., engineer, contract to Killoren Electric Co., Appleton, Wis., 257 miles of line, 592 members; bid, $170,773.

FLORIDA—Talquin Electric Co-operative, Inc., Quincy, C. H. Bentley, supt., and E. P. McLean Engineering Co., Moultrie, Ga., engineer, contract to Miller-Baxter Co., Inc., Indianapolis, Ind., 287 miles of line, 581 members; bid, $160,415.

GEORGIA—Pataula Electric Membership Corp., Cuthbert, W. H. McCauley, supt., and J. B. McCrary Engineering Corp., Atlanta, engineer, contract to W. L. Coston Sons, Bessemer, Ala., 260 miles of line, 619 members; bid, $147,299.

ILLINOIS—Western Illinois Electrical Co-operative, Carthage, Leslie C. Marvel, supt., and Stanley Engineering Co., Muscatine, Iowa, engineer, contract to Stotts Electric Co., Inc., Altamont, Ill., 125 miles of line, 212 members; bid, $96,985.

INDIANA—White County Rural Electric Membership Corp., Monticello, E. R. Ulerich, supt., and R. C. Lennox and J. C. Matthews, Indianapolis, engineer, contract to Contracting & Material Co., Evanston, Ill., 137 miles of line, 350 members; bid, $80,992.

IOWA—Maquoketa Valley Rural Electric Co-operative, Anamosa, Edgar D. Beach, supt., and K. R. Brown, Des Moines, engineer, contract to Evans Construction Co., Early, Iowa, 354 miles of line, 656 members; bid, $246,116.

KANSAS—Sekan Electric Co-operative Association, Inc., Gizard, Olin Leasure, supt., and J. C. Geiger, Girard, engineer, contract to Electric Construction Co., Little Rock, Ark., 110 miles of line, 170 members; bid, $77,853.

KENTUCKY — Henderson-Union Rural Electric Co-operative Corp., Henderson, John R. Hardin, supt., and Ray W. Chanaberry, Inc., Louisville, Ky., engineer, contract to Griffin Electric Co., Inc., Owensboro, 129 miles of line, 317 members; bid, $67,961.

LOUISIANA — Bossier Rural Electric Membership Corp., Bossier, Hugh J. Smith, supt., and Ray W. Chanaberry, Inc., Louisville, engineer, contract to W. H. Smith, Louisville, 147 miles of line, 280 members; bid, $78,654.

MARYLAND—Southern Maryland Tri-County Co-operative Association, Inc., La Plata, Forrest Coakley, manager, and Gibbs & Hill, Inc., New York City, engineer, contract to C. M. Davis & Sons, Harrisburg, Pa., 62 miles of line, 142 members; bid, $54,927.

MINNESOTA—Itasca Mantrap Co-operative Electric Association, Park Rapids, Donald C. Servis, acting supt., and General Engineering Corp., Minneapolis, engineer, contract to E. W. Wylie, Inc., St. Paul, Minn., 272 miles of line, 555 members; bid, $155,519.

MISSISSIPPI — Yazoo Valley Electric Power Association, Yazoo City, C. N. Blakemore, supt., and Bowman & Bowman, Greenwood, Miss., contract to Delta Construction Co., Clarksdale, 40 miles of line, 78 members; bid, $29,248.

MISSOURI—Tri-County Electric Co-operative Association, Lancaster, Joseph H. Casteel, supt., and Stanley Engineering Co., Muscatine, Iowa, engineer, contract to Sandberg & Johnston Construction Co., Hampton, Iowa, 192 miles of line, 335 members; bid, $122,848.

MONTANA—Fergus Electric Co-operative, Inc., Lewistown, Bruce Shavere, supt. and J. M. Garrison, State Water Conservation Board, Helena, engineer, contract to Cahill-Mooney Construction Co., Butte, 179 miles of line, 210 members; bid, $129,966.

NEBRASKA—Burt County Rural Public Power District, Tekamah, E. D. Beck, supt., and H. H. Henningson, Omaha, engineer, contract to Inland Construction Co., Omaha, 73 miles of line, 105 members; bid, $42,133.

NEW MEXICO—Roosevelt County Electric Co-operative, Inc., Portales, Gayle P. Easley, supt., and E. T. Archer & Co., Kansas City, Mo., engineer, contract to Stovall Construction Co., Oklahoma City, Okla., 121 miles of line, 260 members; bid, $63,163.

NORTH CAROLINA—Randolph Electric Membership Corp., Asheboro, C. E. Viverette, supt., and B. O. Vannort, Charlotte, engineer, contract to Bryant Electric Co., Inc., High Point, N. C., 259 miles of line, 660 members; bid, $179,744.

OHIO—Licking Rural Electrification, Inc., Utica, Charles D. Dunlap, supt., and Putnam & Woolpert, Dayton, engineer, contract to L. D. Hetrick, Columbus, Ohio, 195 miles of line, 530 members; bid, $122,984.

OKLAHOMA—Verdigris Valley Electric Co-operative, Inc., Collinsville, R. H. Bishop, manager, and Midwestern Engineering & Construction Co., Tulsa, engineer, contract to Reinhart & Donovan Co., Oklahoma City, 121 miles of line, 213 members; bid, $87,343.

OREGON—Northeast Clackamas County Electric Co-operative, Inc., Sandy, W. Colley, Co-ordinator, and John W. Cunningham & Associates, Portland, Ore., engineer, contract to Wayman & Huenergard, Portland, Ore., 62 miles of line, 170 members; bid, $48,840.

PENNSYLVANIA—Valley Rural Electric Co-operative, Inc., Martinsburg, John Denton, manager, and Gibbs & Hill, Inc., Pennsylvania Station, New York City, engineer, contract to Monroe Electric Co., Chicago, Ill., 150 miles of line, 353 members; bid, $113,444.

SOUTH CAROLINA—Horry Electric Co-operative, Inc., Conway, Lloyd P. Williams, supt., and J. B. McCrary Engineering Corp., Atlanta, Ga., engineer, contract to Day & Zimmermann, Philadelphia, 295 miles of line, 830 members; bid, $177,147.

SOUTH DAKOTA—Butte Electric Association, Inc., Newell, Donald Soma. co-ordinator, and Walter Walkling, Rapid City, engineer, contract to Langford Electric Co., Inc., Minneapolis, Minn., 195 miles of line, 377 members; bid, $122,741.

TENNESSEE—City of LaFollette, J. B. McCrary Engineering Corp., Atlanta, Ga., engineer, contract to Roy Richards, Carrollton, Ga., 144 miles of line, 599 members; bid, $99,822.

TEXAS—Erath County Electric Co-operative Association, Stephenville, G. A. Tunnell, supt., and Freese and Nichols, Fort Worth, engineer, contract to Ainsworth Construction Co., Dallas, 294 miles of line, 554 members; bid, $147,200.

Record in Cable Laying Meets Defense Needs

[*Continued from page 42*]

A graphic schedule was prepared in advance for the use of the men handling operations, tabulating for each 500-ft. station the depth of water, revolutions made by the drum, distance from shore, dynamometer reading for correct cable tension, and the angle that the cable should make off the stern of the ship corresponding to this tension.

As soon as operations got under way, angle shots to the ship were taken with a transit from each end of an 8,231-ft. base line on shore, at intervals of two or three minutes, from which the ship's position was quickly determined on a scale map. Deviation from the course was immediately telephoned to the ship and announced through the loudspeakers, for attention of the tug captain. In spite of tide run, winds and highly devious tendencies of other boats, the ship was held within a few hundred feet of its course at all times.

An observer at the counter on the drum announced the total number of revolutions through the loudspeaker at every tenth revolution, or approximately 250 ft. of cable paid out. Stopwatch readings at each tenth revolution were taken and immediately converted into miles-per-hour ship speed from a prepared table, and any marked deviation from the desired speed was announced for the attention of the tug captain. An average speed of 2.8 m.p.h. was maintained.

Tension Control

The tension in the cable was varied as nearly as possible in accordance with the schedule by the brake operator, who was within sight of the dynamometer and was kept advised of the ship's position by the revolution announcements on the loudspeaker. He was also furnished tension data by the observer reading the angle of the cable leaving the stern, as the dynamometer indications are sometimes sluggish with heavy cable.

A testing engineer in the cable well tested the insulation resistance every few minutes during laying operations, in order to detect immediately any injury to the cable. In such a case, all operations would have been reversed and the cable lifted back into the ship for examination and repairs.

COPPER TO COPPER PREVENTS METALLIC FIGHTS

Forged Copper

8-NU 6-NU 4-NU X2-NU 2-NU 0-NU

Matthews

Nutype Conductor Connectors

FOR COPPER TO COPPER CONNECTIONS

Pure Copper, Cold forged bolt of ample strength for all purposes. High copper content prevents corrosion and season cracking. All edges are rounded. 65,000 pounds tensile value.

"V" groove, clamping jaw of cold forged, pure copper. Flanged sides give greater bearing surface on nut, hence greater strength and no distortion of clamping jaw.

97% copper content, hard metal nut—strong as steel. Full thread engagement with bolt.

Broad, strong head, with size plainly marked. Sides of head have flat surface so wrench or pliers can grip tightly.

85% plus, full thread, die stamped, insures full engagement in nut, hence high strength connectors.

"V" shaped groove, holds wires in three point contact and prevents rocking or looseness.

Made in 12 sizes—6 of forged copper and 6 of machined high strength, high copper content alloy —for No. 10 to 1,000,000 CM conductors.

Send for bulletin and free samples and convince yourself of their superiority.

66-NU X22-NU

44-NU 22-NU

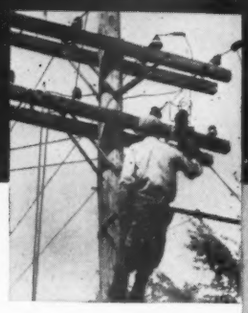
With Nut Retainers

W. N. MATTHEWS CORPORATION

ST. LOUIS, U. S. A.

1939 — FORTY YEARS OF PROGRESS SINCE — 1899

ANODE GLOVES
have plenty of SAFETY APPEAL



● Ability to withstand repeated electrical tests—high resistance to current leakage even after water-soaking—that's what impartial laboratory tests have proved about the safety of Miller Anode Electrician's Gloves.

They're safer, for they're made of pure latex by the Miller Anode Process. They're stronger too, less vulnerable to tearing and snagging. They're more flexible and have unusual resistance to aging.

The cost of these Miller Anode advantages? Not a cent more than for other gloves of equivalent specifications. Your choice of lengths and sizes, straight or "Curv-Flex" (curved finger) designs, for Class A or Class B service.
Drop a card to—

MILLER RUBBER CO., INC.
AKRON, OHIO

Miller ANODE LATEX
ELECTRICIAN'S GLOVES

"Trouble Ahead" ➡ FLASHES THIS NO. 1 TROUBLE SHOOTER at the first sign of service interruption

CHECK the time proven signaling and control equipment listed here. Attach this coupon to your business station-ery. It will bring you complete data.

- U. C. Network Supervisory Systems
- Power Plant Supervisory Systems
- Oil Filled Cable Supervisory Systems
- Supervisory Control Systems
- Electronic Signalling Equipment
- Diagram Boards
- Recording Annunciators
- Special Lamp Annunciators
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A complete staff of electrical and mechanical engineers and draftsmen available for special designs to meet individual problems.

Autocall
POWER PLANT SUPERVISORY SYSTEM

Constant supervision of major operating equipment is vital to the successful operation and maintenance of any power plant. It is for this very reason that expert operators are turning to the AUTOCALL POWER PLANT SUPERVISORY SYSTEM. They know from experience, that it provides freedom from costly service interruption . . . safeguards the continuity of the service you are rendering . . . keeps your power plant costs at a minimum.

THE AUTOCALL CO.
407 Park Ave. SHELBY, OHIO

Usage, Demand Data Prove Economy of Farm Service

[*Continued from page 57*]

A similar experiment in the orchard was unsuccessful, but it was believed that the difficulty was due to improper location of the lamp.

It is planned to extend the experimentation on insect control during the ensuing year. From the farmer's standpoint, it would be a tremendous time and labor saver, and if positive control could be established would no doubt offer the possibility of reducing present loss from insects. From the utility's standpoint it is a particularly attractive load since it is an all-night load, used during the low-use summer months.

The project at the Free Waid farm is similar to the one at the R. N. Moose farm, with some differences in the appliances used. At the Waid farm, however, most of the equipment has been in service for some years and no comparison could be made to determine the savings resulting from rural electrification. Information on operating costs for the various applications has been used effectively in sales promotion.

Terms of Agreement

The projects are operated under the terms of an agreement between the owner and the utility, which provides that the owner keep the necessary records for a period of three years and permits use of this information for sales promotion or other publicity purposes. The power company arranged for the purchase of any equipment needed through dealers and manufacturers on a liberal basis and financed the purchase on favorable terms. Other than this, no subsidy whatever has been made, and the entire responsibility for maintaining and operating the equipment lies with the owner.

Prof. R. U. Blasingame, head of the department of agricultural engineering at Penn State, has been freely consulted and has co-operated extensively in developing the methods by which the projects have been carried out. District vocational agriculture teachers and Future Farmers' Chapters have been particularly interested in the projects, while annual farm tours conducted by the county agents of several counties have included one or both farms in their itinerary.

Recent Legislation

Among the utility bills recently considered in the various state legislatures are the following:

CONNECTICUT—Senate has passed a bill easing or abolishing existing restrictions on the acquisition of electric and gas plants by municipalities. It provides that a city may build, buy or lease electric and gas generating plants if 25 per cent of the voters approve such action. A special election to be called 90 days to 180 days by the mayor for this purpose must be followed by a two-thirds vote of the City Council to make the plan effective. A town or borough may exercise the same authority after a two-third vote by a town or borough called together for such action. Previously a city could take over utility property only after vote of the council, approval by the mayor for two consecutive years and subsequent ratification by voters at the annual city election. The new bill also removes the restriction that municipal electric plants must be located within the limits of municipalities and also permits a city to furnish power for industrial consumption.

MICHIGAN—Representative George Higgins has prepared a bill for introduction in the Legislature abolishing the five-man Public Service Commission and establishing a new nine-member board divided into three autonomous units to hear cases involving utilities, transportation and communication. Representative Higgins said division of the commission's work into three units, each empowered to act in its own sphere, would facilitate hearings and permit appointment of commissioners with specialized training to aid them in rendering decisions. The present board, created by the 1939 Legislature, to supplant the Public Utilities Commission and the Michigan Railroad Commission, now hears all cases sitting en banc, a procedure which Mr. Higgins said delayed disposition of cases. The bill provides for the governor to appoint the commission with Senate approval, to staggered three-year terms instead of the five-year appointments required by the present act.

OREGON—State House taxation and revenue committee decided not to report out a bill to tax services of public electric utilities after Attorney-General I. H. Van Winkle held that it would be unconstitutional to tax public systems on a different basis than private utilities. The original bill included both private and public utilities and would have offset the levy against real property taxation. The committee amended it so that the tax would have applied only to municipal, PUD, and other public plants.

WASHINGTON—Senate Bill No. 45, which provided for electrical inspection in rural areas of the state and licensing of electrical contractors in those areas, failed to pass at the recent session of the Legislature. The bill, sponsored by the Electric Club of Washington, after being passed by the Senate 31 to 5, was defeated in the House because of the many amendments added to it. A bill proposed by Senator Roberts of Seattle to place P.U.D.'s under the State Department of Public Service regulation was defeated 33 to 13. The bill, permitting the refunding of P.U.D. bonds when more favorable rates and terms are available was passed. One proposal enacted authorizes district commissioners to provide for the construction, acquisition or operation of utilities by resolution and permits subsequent additions or extensions in the same resolution. Maximum interest rates on revenue bonds and warrants is fixed at 6 per cent. Another bill passed levies a 2 per cent tax on the gross revenue from the sale of electricity by districts, beginning May 1. Cities and towns are permitted to impose a 3 per cent tax on the gross revenue of public utilities within the city limits, but the districts are empowered to pass such tax on the consumer. The legislation provides that 4 per cent of the state tax shall go to the general fund, and the balance to the county treasurer where such district is operated, to be prorated to the various taxing districts. Another bill, only remotely connected with the P.U.D.s authorizing the state treasurer to prorate to taxing districts any grants which the federal government may make in lieu of ad valorem taxes on federal power projects, was enacted. A bill which would have authorized two or more districts to create a joint district for more economical operation failed to get through. A Senate bill, requiring cities to hold elections on the granting of power franchises passed the House by a 92 to 0 vote.

WISCONSIN—The Beggs bill providing that customers' deposits with public utilities shall go to the state if they are unclaimed after ten years was killed in the state Assembly by a voice vote.

•

Recent Rate Changes

KANSAS GAS & ELECTRIC CO.'s new rate schedule calling for an 11.2 per cent decrease in residential rates for electric energy, which will mean annual savings of $252,000 to its customers in 72 Kansas towns, has been approved by the State Corporation Commission. The towns affected are in southeast and south central Kansas.

LONG ISLAND LIGHTING CO. has been authorized by the New York Public Service Commission to reduce electric rates by $248,100 annually. The revised rates became effective April 15.

PATCHOGUE ELECTRIC LIGHT CO. has been granted by the New York Public Service Commission permission to put into effect revised schedules which will result in savings of $17,800 annually to residential and general consumers of electricity. The new rates will become effective April 20.

ILLINOIS COMMERCE COMMISSION has announced that rate changes effective during the month of March resulted in an estimated increase of $17,177 in annual operating revenues. This figure does not include a reduction in the wholesale rate of the Interstate Light & Power Co. for the sale of electric energy to the Elizabeth Light & Power Co., amounting to $1,975, effective March 1. Electric rate reductions totaled $18,323. An increase in rates by the Interstate Water Co., amounting to $37,000, accounted for the total increase of $17,177.

•

Against St. Lawrence

The Transportation Association of America at a meeting in Chicago recently condemned as being unsound economically and not needed the St. Lawrence seaway and power project. The association represents farmers, shippers, businesses and other groups.

MATTHEWS CONNECTORS

For All Kinds of Wire Connections Without Solder

NUTYPE SERVICE CONNECTORS

For copper to copper—in 12 sizes.

With or without Nut Retainers.

Also available in some sizes for aluminum to aluminum and copper to aluminum connections.

SERVICE ENTRANCE CONNECTORS

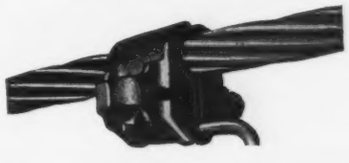
A sturdy and economical means for connecting house service or other end to end copper connections (not under tension).

UNIVISE TELEPHONE

and small copper wire connector.

Vice type—strong and easily connected or disconnected.

PARALLEL CLAMPS



For connecting small tap off wires to larger main conductors at a saving.

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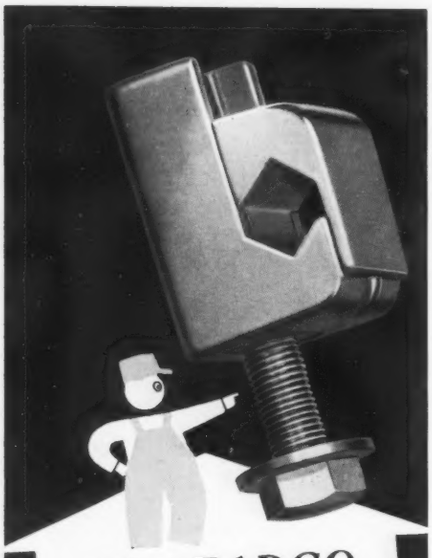
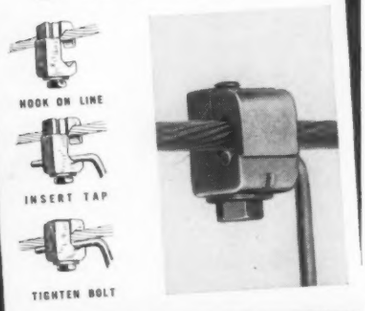
1899 to 1939



Why FARGO
CONNECTORS
"grip like a vise"
at low torque



The small bolt in the Fargo Connector means less friction area in turning . . . *less friction* as you tighten the connector. And the perfect machining of the bolt and body of the Fargo Connector further increases ease of tightening . . . further assures high pressure contacts at remarkably low torque. Specify Fargo Connectors for *repeat use,* too.

Made by FARGO MFG. CO.
Distributed by

LINE MATERIAL CO.
MILWAUKEE, WIS.

Boston Edison Users Assured Ample Power

Boston Edison is in a particularly strong position to meet the demands upon it imposed by the national defense program for power, declared President Frank D. Comerford at the annual meeting of stockholders. "We are in a position to deliver adequate quantities of electric power to all present or prospective customers," he stated.

"Our largest generating plant, L Street, South Boston, which was completely modernized in the past four years, now has 225,000 kw. of capacity. At the Edgar station, North Weymouth, where there have been extensive improvements, the capacity is now 160,000 kw. Under our contract with New England Power Association we have additional firm capacity of 75,000 kw., giving us a total of 460,000 kw., sufficient to take care of any demands for the next two years. Anticipating that the defense program will continue beyond that time, we have ordered 58,000 kw. of generating equipment, which will be available by the autumn of 1942." Mystic station will initially house 40,000 kw.

The 1940 peak load was 405,900 kw., and of the Edison system proper 330,400 kw., the net system output being 1,611,441,551 kw.-hr., of which 188,054,739 kw.-hr. were purchased.

"At present," Mr. Comerford said, "our sales of energy to ultimate consumers are 8 to 12 per cent above a year ago, most of this increase going to industries. In our territory there are as yet no large governmental projects such as army cantonments or huge airplane factories. We anticipate that there will be substantial additions of factory space hereabouts during 1941."

•

Seek System Acquisition

Legislation authorizing the city of Saint John, New Brunswick, to negotiate for the purchase of the New Brunswick Power Co.'s distribution system and to hold a plebiscite on the matter will be introduced at the present session of the New Brunswick Legislature. W. Grant Smith, Saint John City, presented a petition from the city of Saint John that it be allowed to submit a bill covering the matter. Permission was granted.

•

City Plant Net Rises

The Manitowoc, Wis., Public Utilities Commission has reported an increase of $27,855 in net income and earnings of the municipal electric plant in 1940. Sales and other revenues of the electric department increased $23,987 during the year, while operating expenses and other revenue deductions were reduced by $9,869. The report showed that 26,312,000 kw.-hr. was generated during 1940 and 254 electric customers were added.

•

N. Y. Paint Men Talk About Radiant Heat

Progress in radiant energy or "infrared" heating has been retarded by the mistaken application of principles of optics instead of the laws of thermodynamics, Paul H. Goodell, C. M. Hall Lamp Co., told some 140 members of the New York section of the National Paint, Lacquer and Varnish Association last week.

Mr. Goodell went on to point out that radiant energy heating was a matter of regulation of the time-temperature curve for a given heating cycle rather than a question of a "mysterious" wave-length. He stressed that the process was one of curing the paint film rather than one of drying the paint film from the inside out, as it is often referred to.

On the question of economics of the process, Mr. Goodell declared that while the operating cost of the radiant energy heating process might generally be more than with competitive fuels, this increased operating cost was more than offset by the decreased investment cost. In some instances, Mr. Goodell said, the investment cost of a radiant energy oven was less than one-third the cost of a similar installation using another fuel. He pointed out that the recent development of the "sealed" type of radiant heat lamp also minimized maintenance as well as increasing the efficiency of a radiant-heat oven through the more uniform distribution of heat secured.

•

Bonneville Kw.-Day Rate Approved by FPC

Federal Power Commission, at the request of the Bonneville Power Administration, has approved a special rate computed on the kw.-day instead of kw.-year basis for sale of energy to Reynolds Metals Co. for a period not exceeding 90 days after completion of two aluminum production units.

Each unit will require 20,000 kw. at capacity operation. The special rate permits billing on a kw.-day basis from the date of service until the full production demand is reached, not exceeding 90 days.

Recondition Insulating Oil Economically

[*Continued from page 54*]

for fifteen minutes with air agitation. The mixture is then allowed to rest fifteen hours (overnight). Water is then sprayed over the surface of the oil, after which the oil is decanted through a centrifuge and placed in storage for use as needed.

More than 100,000 gal. of insulating oil which would otherwise have been discarded has been reconditioned and placed in service. The process can be repeated on an oil any number of times with satisfactory results.

A plant of the size described, operating on a basis of 40,000 gal. yearly, is an excellent investment for large users of insulating oil. The labor and material costs, exclusive of transportation, approximate 4 cents per gallon. As the fixed charges on the plant total 3 cents per gallon, the over-all cost is 7 cents.

Distribution Goes Under-ground

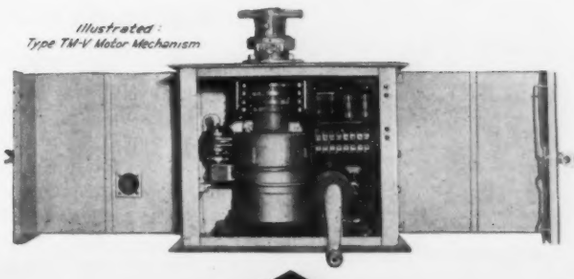
[*Continued from page 59*]

phase carries the bulk of the welding duty.

Factory lighting is provided by 500-watt incandescent lamps in RLM type "snap-on" fixtures mounted on 12x13-ft. centers 13 ft. above the floor. General illumination is about 25 foot-candles. Supplementary lighting is supplied where needed for close work. It should be noted that subfeeders for the lighting circuits, emanating from the distribution panels, are rigid conduit, instead of the metal-inclosed duct dictated for the power circuits, because of the need for maximum accessibility.

HIGH GRADE
HARD PORCELAIN
FOR
Electrical Specialties
High and Low Voltages

IMPERIAL
PORCELAIN WORKS
TRENTON, NEW JERSEY



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Automatic Transfer of Important Loads

Protect important defense loads on your system with instantaneous or time-delay transfers by using Southern States' motor mechanisms. Construction is rugged; operation is dependable. Investigate Southern States' mechanisms now—complete details will be sent to you by return mail.

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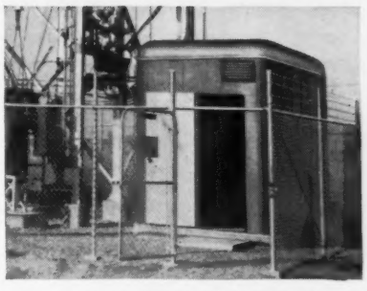
BUTLER READY-MADE STEEL BUILDINGS

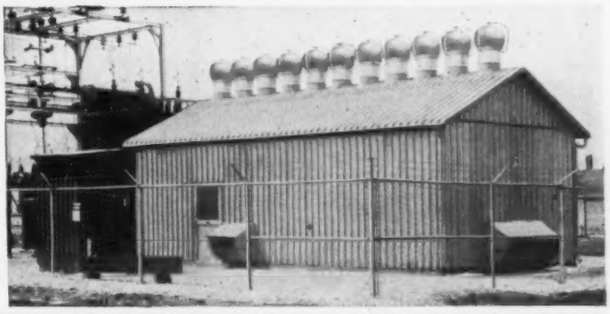


Above—**BUTLER STEEL TRUCK GARAGE**—40′ x 74′ x 10′ equipped with overhead doors. Butler round-roof buildings are available with clear spans of 100′, any length—also with monitor roof.

The **BUTLER BOULEVARD BUILDING** above is 8′ x 12′ x 8′6″ and houses **SUB-STATION** control equipment. It has double panel steel walls—Steel inside and outside—with insulation between and available in many strikingly beautiful functional designs.

The **BUTLER ALL-PURPOSE BUILDING** at right is 16′ x 34′ x 10′ and houses **SYNCHRONOUS CONDENSER** high voltage control equipment. Ventilated for 20,000 cu. ft. air displacement per min.

Before you build get full facts on this 25 year old development in factory fabricated steel buildings.



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Send Steel Building Book and Data on.....
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ft. x..... ft. x..... ft.

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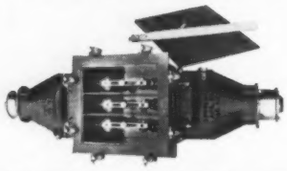

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Designed to meet rigid standards over a wide range of service requirements.

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Free Hand for REA Opposed in Bay State

Vigorous condemnation of Senator Dolan's proposed rural electric cooperative bill to give vast powers to REA projects in Massachusetts was voiced at Boston recently at a hearing before the legislative committee on rules. John E. Donohue, counsel for the REA, Washington, D. C., and E. B. Van Horn of the latter's division of loans, supported the measure, which was before the committee on the question of admitting it to the calendar, January 11 having been the closing date for new legislation. Sheldon E. Wardwell represented the leading gas and electric utilities of the state.

Mr. Donahue said that 45 states have utilized REA funds aggregating about $350,000,000 in five years, and that $190,000 will immediately be available for Massachusetts rural electric cooperatives if the bill goes through. Mr. Van Horn outlined areas which the REA considered important for rural line extensions, estimating that about 10,500 farms or farm homes would be served. These speakers pointed out that the policy of the REA is to buy power from existing private or municipal utilities wherever possible, and that out of 811 borrowers in the country, generating plants have been set up in but 25 cases.

Members of the committee questioned the accuracy of the data submitted by the REA as to the available farm homes outside central station territory. Mr. Wardwell quoted U. S. Census figures showing that 76 per cent of the farm homes of the state now have electric utility service, the total supplied being 23,610 in 1941, against 14,088 in 1930. Only two towns in the state are now without service, and these will probably be provided with it this year. The bill contains excessive powers which would sweep state regulation into the discard, the speaker declared.

•

Pipe Protection

That no bituminous coating appears to afford complete protection to underground pipe lines under all conditions is the conclusion reached by experts of the National Bureau of Standards, who have been studying this subject for a long period in co-operation with the American Petroleum Institute.

•

Elephant Butte Line

The Elephant Butte electric power transmission system will be extended to Deming, Central and Silver City, all in New Mexico, according to L. R. Fiock of El Paso, superintendent of the project. The Deming line will tie in with the line of the Community Public Service Co., now serving that area and Lordsburg. Power for Deming will be delivered at that point to the Deming Ice & Electric Co.

•

City Plant Nets $242,323

Board of Public Utilities, Jamestown, N. Y., has announced that the net earnings of the electric system in 1940, after depreciation, interest, taxes and tax equivalents, are $242,323, compared with $180,386 in 1939. After the payment of a consumers' dividend in 1940 of $177,956 to consumers of electricity other than the city of Jamestown, $64,367 was transferred to surplus.

•

Energy Tax Cut in Half

The city of Winnipeg's special taxes on light and power consumption were cut in half recently by the Manitoba Legislature shortly before the session was prorogued. The tax reduction, effective May 1, will drop the rate on domestic bills from 5 to 2½ per cent and on commercial bills from 10 to 5 per cent.

•

Project Nears Completion

The Quebec Government's new power development at No. 7 Rapids on the Upper Ottawa River will be in operation by next August, according to a statement made by Hon. Edgar Rochette, Quebec provincial minister of mines. The installation will comprise three units of 16,000 hp. each, with the possibility of a fourth unit later.

•

Denies Dam Postponement

The Federal Power Commission has denied the application of Arkansas Power & Light Co. for an amendment of its license to postpone indefinitely the construction and completion of the Blakely Dam development of its large hydro-electric project on the Ouachita River in Arkansas.

•

Approves Diesel Unit

Fennimore, Wis., City Council has unanimously approved contracts for an $85,000 Diesel generating plant to furnish power for the city's municipal electric distribution system. Fennimore has been receiving energy for its utility from the Interstate Power Co., and the question of furnishing its own power is to be decided upon at a referendum at the April election.

70 MASTER-LIGHTS
for Better, Faster Night Repairs
High Power and Convenience to Increase the Efficiency of Your Line Crews

Type "T"
The most powerful automobile spotlight made. (Roof-type (Inside Pistol Grip Control). Range one-mile. Swings in complete circle, any angle, up or down. Penetrates fog or smoke. Operates from car battery. Best construction throughout. Chrome plated, polished, aluminum handle. No gears to wear or rattle. Rust and weather-proof.

• Type T, above, is but one of the 70 Master-Lights that help give your line and repair crews adequate light to speed up emergency jobs, end outages more quickly, retain customer goodwill. Types available include worklights, searchlights, floodlights, warning lights, patrol lights, watchman's light . . . and other lights for all conditions. 30-day free trial. Send for descriptive literature.

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TRICO FUSE PULLERS are cheap insurance against shocks, burns, infections, lost time and unnecessary compensation costs.
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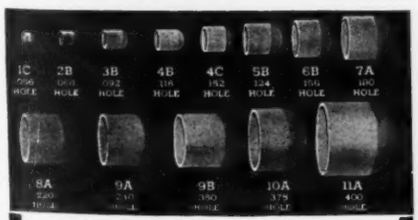

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Use **Lavolain** ball and socket beads for insulating bare wire. Heat resistant. High di-electric and mechanical strength. Made in U. S. A. Quality beads at low cost. Quickly applied. Flexible. Beads shown above are approximately half actual size. Ask for price list and samples.
STAR PORCELAIN CO.
TRENTON, N. J.

LETTERS TO THE EDITOR

Pivoted Flashboards

To the Editor of ELECTRICAL WORLD:

In our program of generating electricity and delivering irrigation water to 4,000 acres we raise the level of Gunnison River at the canal intake about 4 ft. at all times except in the spring flood by means of 2 x 10-in. flashboards about 4 ft. long. Installing or removing these flashboards is always a strenuous and hazardous job, done, as it must be, while there is more or less discharge over the crest of the dam. We were much interested, therefore, in the swinging flashboards at Belton, S. C., as described in the February 22 ELECTRICAL WORLD (page 51) because they would seem to obviate our difficulties. But what method is used to swing the sections back into line and latch them in closed position?

F. C. MERRIELL, Con. Engr.
Redlands Water & Power Co.,
Grand Junction, Colo.

To the Editor of ELECTRICAL WORLD:

One detail not mentioned in the February 22 article was the provision of a 10-in. channel section anchored and grouted to the top of the spillway. These are lined up against the upstream side of the 8-in. pipe hinge posts to form a true, smooth base for the swing gates. Also, the U-bolts are tightened to give only a slight friction drag when the gates rotate about the posts. Two men can throw a rope loop over the tip of a gate in the open position and swing it through 90 deg. to the closed position over the channel atop the spillway. Half the gates face the right and are latched at the right abutment. With two crews of three men each we have closed the 48 gates across the 385-ft. spillway in 1½ hours. The plant is below three others on the river and reports from them give us ample opportunity to close or open the gates. Closing the gates is generally not attempted when there is flow over the spillway, but it was done once with water 2 in. over spillway crest.

The stainless steel pins which replace the gates are 1 in. in diameter and not ¼ in., as indicated in the article.

JULIAN WALTON, Superintendent
Belton Light & Power Co.,
Belton, S. C.

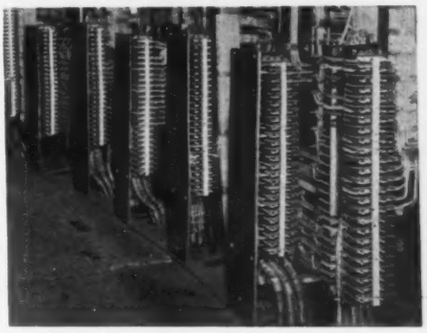
•

Authorizes New Lines

Illinois Commerce Commission has authorized Illinois Iowa Power Co. to construct 5.15 miles of rural power line.

STATES TESTING EQUIPMENT

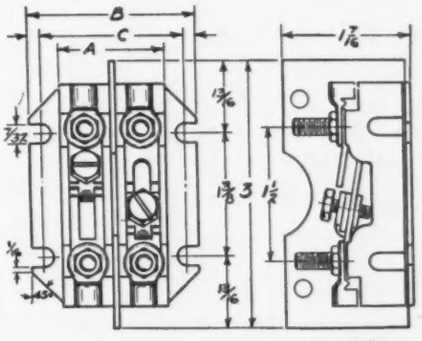
Most Panelboards Need Type NT Terminal Blocks



An excellent method for terminating incoming cables and panel connections.

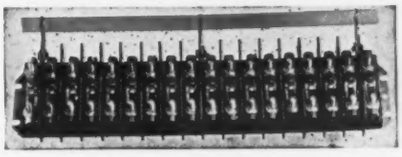
STATES Terminal Blocks provide disconnect features—they permit testing panel circuits *without disturbing permanent wiring.* They save space.

Type NT Terminal Blocks may be obtained in any number of poles with or without coding strip, with or without cover, front or back connected. See Cat. No. 1, Sec. 6, which gives full information.



LINK OPEN

Are You Cramped for Panel Space?



Tear off and Mail Today

To the STATES Company
Hartford, Conn.

Please send full information on Type NT Terminal Blocks

Name .....

Title .....

Firm .....

City ..... *State*.....

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THE ONE-STEP METHOD
Bill Frequency Analyzer

102 Maiden Lane New York

READERS MAY CONTACT

the consultants whose cards appear on this page with the confidence justified by the offering of these special services nationally.

Sales Opportunities

PENSACOLA, OKLA.—Grand River Dam Authority, Vinita, Okla., has plans under way for expansion in generating station, transmission lines, power substations and auxiliary structures. At hydroelectric power plant on Grand River, near Pensacola, Okla., it is proposed to install another turbine-generator, making the fifth such unit at station and developing a total capacity of 53,000-kw. for plant. Two new 110,000-volt transmission line circuits are planned to Tulsa and vicinity, with 60,000-volt branch line to new airplane plant of Government now being constructed on site near city, where power substation will be located. Another 69,000-volt transmission line will be constructed to the lead and zinc-mining area of State, vicinity of Miami, for service in that district, where a terminal substation will be situated for local distribution. Entire project is estimated to cost about $2,364,000. Financing will be arranged through Federal aid. Holway & Neuffer, 307 East Eighteenth Street, Tulsa, are consulting engineers for Authority.

BUTLER, PA.—American Rolling Mill Co., Middletown, Ohio, plans installation of heavy-duty motors and controls, switchgear, duct lines, electric furnace and accessories, conveyors, electric hoists and other equipment in new addition to branch mill at Butler. Proposed to begin work in May. Cost estimated about $650,000.

CHICAGO, ILL.—Commonwealth Edison Co. has taken out a permit for new indoor power substation at 3006 West Fulton Street, previously referred to in these columns, and will proceed with work at once. Cost reported over $40,000, with equipment.

WEST POINT, IOWA—City Council plans installation of a municipal electrical distribution system, including 11,000-volt transmission line from outside connection to new power substation to be located in city, distribution lines and street-lighting system, service facilities, etc. Estimates of cost are being completed. G. L. Van Fleet Company, Cedar Falls, Iowa, is consulting engineer.

PORTLAND, ORE.—Electro Metallurgical Co. and Union Carbide Co., both 30 East 42d Street, New York, N. Y., associated interests of Union Carbide & Carbon Corp., same address, plan installation of electric furnaces and accessories, motors and controls, switchgear, duct lines, regulators, industrial lighting system, conveyors and other equipment in new joint plant on large tract of land recently acquired near St. Johns district, Portland. It will comprise a group of one and multi-story units, with all equipment electrically-operated. Contract is being arranged with Bonneville Administration, Department of Interior, Portland, for power supply from Bonneville transmission system, on basis of initial connected load of 35,000-kw. Power substation will be built at plant site for this service. Entire project is reported to cost over $1,500,000. Proposed to begin work at early date.

ROCKFORD, ILL.—Central Illinois Electric & Gas Co., Rockford, plans extensions in primary and secondary lines in vicinity of Rockford and New Milford, totaling close to 38 miles, for expansion in rural electric system, including service facilities. Work is scheduled to be carried out this spring.

NEWPORT, R. I.—Bureau of Yards and Docks, Navy Department, Washington, D. C., plans expansion and improvements in power plant at naval torpedo station, Newport, including installation of additional equipment. Work will be carried out in conjunction with additional torpedo-manufacturing buildings and facilities, and other structures, for which a total appropriation of about $2,850,000 is being arranged.

JEFFERSON, WIS.—Water and Light Department, Nathan Fischer, superintendent, plans early purchase of equipment and materials for installation of an ornamental street-lighting system on Wilson, Dodge, Dewey and other streets. Proposed to carry out work with municipal forces.

DUNKIRK, N. Y.—Allegheny Ludlum Steel Corp., Oliver Building, Pittsburgh, Pa., plans installation of heavy-duty motors and controls, switchgear, duct lines, conveyors, electric hoists and other equipment in new addition to branch mill at Dunkirk, for production of alloy steels for Government, which will provide a fund of $2,500,000 for project through Defense Plant Corporation, Washington, D. C., Federal Agency. Work is scheduled to begin at early date.

•

Stockholders' Approval

At the meeting to be held on April 23 stockholders of Continental-Diamond Fibre Co. will consider approving the action of the board of directors in 1940 in applying the profit-and-loss deficit of $1,375,401 as of December 31, 1939, to capital surplus.

•

Parker Dam Contract Let

Bureau of Reclamation, Washington, D. C., has awarded a contract to Chase Brass & Copper Co., Inc., Waterbury, Conn., at $16,205 for furnishing copper bus tubing for Parker Dam project (Circular 44258-A).

•

British Radio Exports

Radio exports from Great Britain in 1940 totaled £1,298,832, with India, the main market, taking 20,900 units, or more than double the total the year before. South Africa was the next best market with a total of £100,000. The average price to India was £6.93. It was stated that high duties and freights have kept British radio sets out of the poorer Indian homes and that British manufacturers are now aiming at producing a "people's set" especially for them.

•

Transformer Contract

Wagner Electric Corp. has been awarded a contract for a $25,798 transformer to be installed at the Bonneville Dam.

CHEMICAL DEHYDRATORS
FOR
PREVENTING CONDENSATION
IN AUTOMATIC SUBSTATIONS

•

MFGD. BY

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This sign becomes effective only when property is protected by a Stewart Non-Climable Chain Link Wire Fence. Stewart Fences assure continuous, dependable protection and exclusion of enemy agents. Next month may be too late—you need Stewart protection NOW! Send for Catalog No. 79. Sales and Erection offices in principal cities.

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866 Stewart Block Cincinnati, Ohio

"Fence Builders to America Since 1886"

Stewart IRON and WIRE FENCES

FPC Issues Annual Report on Rates

Rate reductions in one or more typical bills for residential service were made by 60 utilities in 65 cities of more than 50,000 population in 1940, out of a total of 157 utilities serving 199 such cities, according to the Federal Power Commission annual survey of electric rates.

Rate increases in such bills were made in eleven cities. In three cases the increases were for certain blocks of consumption only and were accompanied by decreases in bills for other blocks. The remaining eight cases were all occasioned by the operation of tax clauses and the increases involved were relatively small, ranging from 1 to 4 cents per bill.

Commenting on the downward trend in average residential bills since October 1, 1924, the study shows decreases from 7.7 to 5.4 cents per kw.-hr. for monthly bills of 25 kw.-hr., 6.2 to 3.8 cents per kw.-hr. for 100 kw.-hr. and 5.3 to 2.8 cents per kw.-hr. for 250 kw.-hr.

Copies of the report, which includes electric rates as of January 1, 1941, for residential, commercial light, commercial power and industrial service, are available from the Federal Power Commission, Washington, D. C., at 10 cents each.

•

Utility Retains Earnings

Dividend payments on the common stock of American Water Works & Electric Co. will not be resumed for the present, it was indicated in the annual report. "In view of the many problems" facing the company, "directors have believed it unwise" to distribute any portion of earnings to the equity holders, the report stated. Officials expressed the belief that earnings should be retained to strengthen the financial position of the company.

•

Permits System Transfer

New York Public Service Commission has authorized the New York State Electric & Gas Corp. to transfer its works and system in the towns of Forestburg and Mamakating, Sullivan County, and in the towns of Deer Park and Wallkill, Orange County, to the Rockland Light & Power Co. for a consideration not to exceed $25,984. Both companies joined in the petition for the commission's consent to the transfer. The purpose of the transfer is to rectify certain overlapping of franchises and irregularities in operations.

SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT : "OPPORTUNITIES" : EQUIPMENT
BUSINESS : : USED OR RESALE

UNDISPLAYED —RATES— DISPLAYED

10 CENTS A WORD. MINIMUM CHARGE $2.00
Positions Wanted (full or part time salaried employment only), ½ the above rates payable in advance.
Box Numbers—Care of publication New York, Chicago or San Francisco offices count as 10 words.
Discount of 10% if full payment is made in advance for 4 consecutive insertions.

Individual Spaces with border rules for prominent display of advertisements.
The advertising rate is $6.50 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.
An advertising inch is measured ⅞" vertically on one column, 3 columns—30 inches—to a page.

NEW ADVERTISEMENTS received by 10 A. M. Monday will appear in Saturday's issue, subject to limitations of space available.

POSITIONS VACANT

ELECTRICAL DRAFTSMAN—Preferably electrical graduate, with experience on industrial plant conduit and wiring systems, including lighting, power, controls and sub-stations. Permanent organization. Give complete record of experience and salary desired. Location—Michigan. P-894, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

EMPLOYMENT SERVICE

SALARIED POSITIONS, $2,500 to $25,000. This thoroughly organized advertising service of 31 years' recognized standing and reputation carries on preliminary negotiations for positions of the calibre indicated above, through a procedure individualized to each client's personal requirements. Several weeks are required to negotiate and each individual must finance the moderate cost of his own campaign. Retaining fee protected by a refund provision as stipulated in our agreement. Identity is covered and, if employed, present position protected. If your salary has been $2,500 or more, send only name and address for details. R. W. Bixby, Inc., 262 Delward Bldg., Buffalo, N. Y.

Executives and Technical Men. Qualified candidate desiring $2,500 to $20,000 position may contact employers through our confidential services, established 25 years. The National Business Bourse, 20 W. Jackson Blvd., Chicago.

POSITIONS WANTED

(See also "Selling Opportunity Wanted")

DISTRIBUTION ENGINEER. Southerner. Thoroughly competent in design, supervision, operation and office management. Reasonable notice due present employer. South preferred. PW-891, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

PRACTICAL ELECTRICIAN with eighteen years experience on maintenance of electrical and mechanical equipment. Desire position as superintendent or assistant on electrical or mechanical maintenance. Also qualified as foreman on electrical assembly work. Location immaterial. PW-893, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

EXECUTIVE ENGINEER — Ohio State Registered — 50 years old, in excellent health: Experienced in Design, construction, operation, valuation and rate making, financing and general management: Seeks executive position, or position as assistant to executive. Can cope with any political situation: Employed at present—reasonable notice to make change. Address PW-895, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

SELLING OPPORTUNITIES

OFFERED—WANTED

Selling Agencies—Sales Executives
Salesmen—Additional Lines

OPPORTUNITY WANTED

EASTERN REPRESENTATION. Manufacturers' agent with twenty years experience in the electrical trade in New England and New York States desires two additional lines on manufacturing agency basis. Excellent contacts. For additional information, write RA-892, Electrical World, 330 W. 42nd St., New York, N. Y.

SPECIALTIES

CABLE-SPLICERS WIPING CLOTHS. Formed-flexible finishing cloths (Patented); Flat finishing cloths; Catch cloths; Crotch cloths and Up-right joint catch cloths. Made of world-prize Herringbone Ticking or imported English Moleskin. Write us for literature and prices. Geo. E. Williams, Mfr., 3035 Aldrich Avenue, Minneapolis, Minn.

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PROPERTIES AND PLANTS
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STEEL AND BRICK BUILDING—Modern, one-story, containing approximately 28,000 sq. ft. of floor space. Building is well lighted and equipped with two 3-ton and two 5-ton floor-operated cranes. Separate service building equipped with washroom and toilet facilities, and an office building with an area of 2,400 sq. ft. Parking space nearby. Shipping facilities include spur track into main building arranged for car-floor-level loading. All contained on about 1¾ acres, approximately 75,000 square feet of land. Houston, Texas.

3-STORY BUILDING containing 42,000 sq. ft. of floor space suitable for light manufacturing, warehousing or sales purposes. Located in the center of city. Railway siding nearby. Tulsa, Okla.

6 ACRES OF LAND located at Locust Avenue and West 112th Street, with railroad siding. All cleared. Suitable for either building or storage purposes. Cleveland, Ohio.

For detailed information or an appointment to inspect these properties, write

BO 880, Electrical World
330 W. 42nd St., New York City

WANTED

(Additional Equipment Wanted Advertising on opposite page)

WANTED TO PURCHASE OR RENT

Either new or used

4—Single phase auto-transformers, 750 KVA capacity each, 25400/12700 volts, with a 2300 volt tertiary winding on each transformer with approximately 35% capacity in the tertiary winding including automatic tap changing under load, the taps to range from 25400 volts to 20300 volts in steps not to be in excess of 2½% with full capacity taps to include clamp type terminals on the bushings, temperature indicators, oil level indicators, oil drain valves and oil sampling valves.

ALTERNATE: 3—Two winding, single phase transformers, 750 KVA each, 44000/22000 volts with automatic tap changing under load, taps to range from 44000 to 32500 volts and to be not in excess of 2½% steps with full capacity taps including clamp type terminals on the bushings, temperature indicator, oil level indicators, oil drain valves and oil sampling valves.

W-890, Electrical World
330 W. 42nd St., New York City